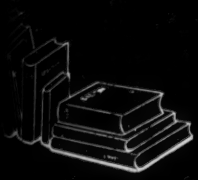
ABSTRACTS OF NORTH AMERICAN GEOLOGY



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ABSTRACTS OF NORTH AMERICAN GEOLOGY

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ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports or memorandums) or of other papers presented orally at meetings.

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The abstracts in this issue were prepared by Augustus K. Armstrong, Paul Averitt, William P. Brosgé, Georgianna D. Conant, Howard R. Cramer, John H. Feth, Val L. Freeman, S. E. Frezon, Katherine A. Friberg, Richard E. Grant, Andrew Griscom, John L. Hass, Anna Hietanen-Makela, John W. Hosterman, John W. Huddle, Virginia M. Jussen, B. H. Kent, R. A. Loney, Elisabeth S. Loud, Sergius H. Mamay, Edwin H. McKee, Mildred C. Mead, Mary E. Mrose, Willis H. Nelson, Virginia S. Neuschel, A. Thomas Ovenshine, Willard P. Puffett, D. W. Rankin, Louis L. Ray, Henry W. Roehler, E. G. Sable, Marie Siegrist, Harry A. Tourtelot, Dorothy B. Vitaliano, Gordon H. Wood, and Ellis L. Yochelson.

ABSTRACTS

05985 **Adams, Donald D.; Richards, Francis A.** Dissolved organic matter in an anoxic fjord, with special reference to the presence of mercaptans: Deep-Sea Research, v. 15, no. 4, p. 471–481, illus., tables, 1968.

Petroleum ether and ethyl acetate extraction of acidified sea water [from Lake Nitinat, Vancouver Island, British Columbia] recovered some 40–60 percent of the dissolved organic carbon. Anoxic waters yielded 1.8–1.9 mg/l of dissolved organic matter and oxygen-rearing waters, 1.0–1.2 mg/l. Most of the polar organic constituents detected in the oxygen-bearing water were absent in the anoxic zone, and the carbon content of the extracted matter increased markedly with depth of the anoxic zone. On the basis of chromatographic behavior and spot tests the following classes of compounds were tentatively identified: sterols or sterol esters, choline-containing lipids, and ninhydrin-positive compounds. These were found in both oxygen-bearing and anoxic waters, while non-polar and polar nonvolatile mercaptans were detected in the anoxic water.—Authors' abstract

Akhtar, Salim. *See* Parks, George A. 05931

Alexandrov, V. A. *See* Finks, R. M. 00272

Ali, Physool. *See* Brooker, E. W. 06063

00118 **Alker, Julius.** *Paciculus* (Cricetinae, incertae sedis) teeth from the Miocene of Nebraska: Jour. Paleontology, v. 43, no. 1, p. 171–174, illus., tables, 1969.

Two upper tooth rows and nine specimens of lower dentitions, referred to the rodent *Paciculus insolitus* Cope, were collected from the lower Miocene above the Brule–Gering contact in western Nebraska. A specimen from the same level consisting of lower teeth and skeletal fragments is described as a new species, *P. nebraskensis*. The upper molars show cricetine affinities, whereas all the lower molars are similar to those of *Zapus hudsonius campestri*. Until lower and upper dentitions known to be from the same individual are collected, *Paciculus* will remain a taxonomic questionmark, classified as Subfamily Cricetinae *incertae sedis*.—Author's abstract

00284 **Allingham, John W.** Baltimore gabbro complex—alpine or stratiform [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 1, 1969.

00285 **Alterman, Ina B.** An Ordovician boulder conglomerate at the base of the Hamburg klippe, east-central Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 1–2, 1969.

06163 **Am.Soc. for Testing and Materials.** (Comm. E-2 on Emission Spectroscopy). Methods for emission spectrochemical analysis (5th edition): Philadelphia, Pa., Am. Soc. Testing and Materials, 919 p., illus., tables, 1968.

All current spectrochemical practices and methods published by ASTM are included, as well as others that are particularly useful. The first 182 pages cover general topics, and the balance is devoted to a section on analysis of 25 metals, and one on nonmetallic materials.—ESL

00173 **Am. Society of Civil Engineers.** (Soil Mechanics Div., Comm. Inf. Retrieval). Information retrieval for soil engineers—Closure [to discussion of paper 5471, 1967]: Am. Soc.Civil Engineers Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 341, 1969.

This committee report stresses the need for authors to prepare informational abstracts (original report, ibid., v. 93, no. SM 5, pt. 2, 180 p., 1967). The Soil Mechanics Thesaurus was prepared to aid in selection of key words for retrieval. The expanded committee is preparing or editing abstracts and keywords of non-ASCE papers for an International Abstracts Section of the Journal.—ESL

Anderson, Orson L. *See* Thomsen, Leon. 00072

06109 **Anderson, Orson L.; Schreiber, Edward; Liebermann, Robert C.** Some elastic constant data on minerals relevant to geophysics: Rev. Geophysics, v. 6, no. 4, p. 491–524, illus., tables, 1968.

Measurements of elastic constants and related pressure and temperature derivatives of ten compounds [corundum, periclase, spinel, forsterite, garnet, hematite, quartz, lime, zincite, bromellite] of interest to geophysical and geochemical theories are reported and analyzed. We discuss corrections that are expected from effects of anisotropy and porosity and conclude that polycrystalline samples with porosities of 4 percent are not adequate for reliable acoustic measurements. We find that two anharmonic parameters are independent of temperature at high temperature, and we use this result to estimate temperature derivative of bulk modulus at high temperatures. We present a number of correlations between the elastic constants and illustrate their use by attempting to predict the unmeasured elastic properties of fayalite.—*from* Authors' abstract

05949 **Anderson, W. B.** Riley's scanagraph—A method for automatically digitizing oil well logs, *in* Formation evaluation symposium, 2d Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p.G1–G7, illus., 1968.

Riley's Scanagraph is a flying spot scanner that automatically digitizes oil well logs. The paper describes the device itself which scans half scale negatives of the logs and also describes the computer program which unscrambles the curve crossings.—Author's abstract

00058 **Anderssen, R. S.** On the solution of certain overdetermined systems of linear equations that arise in geophysics: Jour. Geophys. Research, v. 74, no. 4, p. 1045–1051, 1969.

Recent results in numerical analysis on the solution of overdetermined systems of linear equations by the least-squares method are used to shed more light on a series of papers on the best procedure for generating a spherical harmonic analysis of a magnetic disturbance. Fougere's original suggestion (1963) has certain computational advantages, but its implementation should be reformulated. As a result of reformulation, the method of solution for an overdetermined system of linear equations (such as arises in generation of a spherical harmonic analysis) must be based on the use of modified Gram–Schmidt orthonormalization. Though the generation of a spherical harmonic analysis is the only geophysical application discussed in any detail, the conclusions of this paper apply to any geophysical analysis that reduces to the solution of an overdetermined system of linear equations.—*from* Author's abstract

06073 **Andreyev, B.A.** (and others). The history of geological evolution of the north-eastern Asia and Alaska, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 3, Orogenic belts: Prague, Academia, p. 299–303, 1968.

The geological evolution of the eastern USSR and adjacent territories has been established. In the early and middle Paleozoic there was a predominance of connections with Atlantic and Pacific basins, in the late Paleozoic and early Mesozoic with Mediterranean and Pacific basins, and in late Mesozoic and Cenozoic with the Pacific basin. After the early Archean, formation of Aldanids took place; after early Proterozoic, formation of Stanovids took place; and after Early

Cambrian, Baikalids were formed. During the Cenozoic in extreme east Asia and in southern Alaska, systems of island arcs were formed.—KAF

00122 **Arai, Mary Needler; McGugan, Alan.** A problematical Cambrian coelenterate?: Jour. Paleontology, v. 43, no. 1, p. 93–94, illus., 1969.

Additional material ["A problematical coelenterate(?) from . . . Alberta", ibid., v. 42, no. 1, p. 205–209, 1968], obtained from the Cambrian of Nevada [sandstone casts of *Bergaueria* from near Goldfield] displays biradially symmetrical impressions which are interpreted as anthozoan in origin.—Authors' abstract

Archbald, David. *See* Bowser, Carl J. 06188

Arndt, Harold H. *See* Wood, Gordon H., Jr. 00066

Arrington, Frank. *See* Taft, William H. 06319

00136 **Asseez, L.Olayinka.** Paleogeography of Lower Mississippian rocks of Michigan basin: Am.Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 127–135, illus., tables, 1969.

The Antrim, Ellsworth, Bedford, Berea, and Sunbury Formations of Michigan were studied to determine Early Mississippian paleogeography and to develop techniques for studying thick shale sequences with variable properties both laterally and vertically. Variables assessed were color, thickness, lithologic ratio, and texture. Post-Antrim sediments, derived from separate source areas, produced the birdfoot Bedford–Berea delta from the northeast and a thick green shale, the Ellsworth Shale, from the northwest. Localization of rock types on opposite sides of the Michigan basin was not affected by a structural or topographic barrier, but by an environment in which all sediments deposited were primarily or secondarily black. Maps and cross sections delineate rock types.—HWR

00286 **Austin, Nancy C.** Subsurface Tully Limestone, New York and northern Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec.,p. 2, 1969.

00149 **Averitt, Paul.** Coal resources of the United States, January 1, 1967: U.S. Geol. Survey Bull. 1275, 116 p., illus., tables, 1969.

The coal resources of the United States remaining in the ground on January 1, 1967, totaled 3,210 billion tons. This figure comprises 1,560 billion tons determined by mapping and exploration, and 1,650 billion tons estimated to be present in unmapped and unexplored areas. About half of the tonnage is recoverable. The United States contains about 17 percent of the world's coal resources as determined by mapping and exploration, and about 20 percent of the world's estimated total resources. On a uniform Btu basis, coal constitutes 73 percent of the United States fossil fuel supply, whereas petroleum and natural gas together constitute only 9 percent, and oil in oil shale constitutes 17 percent.—PA

Avignone, N.F. *See* Finks, R. M. 00272

Bailey, William A. *See* Whitman, Robert V. 00170

06033 **Baird, Donald; Patterson, O. F., 3d.** Archosaur fauna in the Pekin Formation (Upper Triassic) of North Carolina [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4,p. 439, 1968.

06059 **Baker, R.; Kassiff, G.** Mathematical analysis of swell pressure with time for partly saturated clays: Canadian Geotech. Jour., v. 5, no. 4, p. 217–224, illus., 1968.

Experimental results of swell pressure under complete inundation show that the curve of pressure against log of time has a typical reversed S shape, similar to that of consolidation. No endeavour, however, has been made to explain this behaviour theoretically. The paper deals with the mathematical derivation of the swell pressure

function and the definition of the parameters involved. Under certain simplified assumptions, it is shown that the dissipation function is mathematically identical with that of the consolidation process. The solution of this function yielded a rather simple expression for the swell pressure, which agrees with values obtained when the clay is saturated and results in a fraction of the initial suction when the clay is partly saturated.—Authors' abstract

Bakken, W. E. *See* Mohl, K. L. 05881

06046 **Bannerman, Harold M.; Quarrier, Sidney S.; Schooner, Richard.** Mineral deposits of the central Connecticut pegmatite district, Trip F-6 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 7 p., paged separately, illus., 1968.

Three stops on the trip are described. The Middletown district is the most important pegmatite area, and is fully discussed. There are well over 400 pegmatites in the district ranging from a few inches wide to 100 feet. They intrude all of the rocks of the region although most are in the Bolton Schist, and are granitic for the most part, and consist of microcline perthite, sodic plagioclase, quartz, and muscovite and occasionally some biotite. Over 110 mineral species known from the district are listed. Feldspar and sheet mica are the important mineral resources, and many rare minerals, some semi-precious gems, and a large number of fine mineral specimens, are to be found also.—HRC

00159 **Barden, Laing; Poskitt, Trevor J.** General stress-strain-time function for soils—Discussion [of paper 5728 by A. Singh and J. K. Mitchell, 1968]: Am. Soc. Civil Engineers Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p.406–409, illus., 1969.

The paper (ibid., v. 94, no. SM 1, p. 21–46) is a stimulating contribution to the subject. Eq. 9 is an extremely simple and useful semi-empirical relation, and is a generalization of the completely empirical relation proposed for the one-dimensional compression of peat soil. It is suggested that Eq. 9 be developed in terms of the effective stress ratio R rather than the deviator stress D. Tests of longer duration are needed to have more relevance to the field. The use of rheological models to measure creep is discussed.—ESL

Barden, Laing. *See* Rowe, P. W. 00176

05988 **Baro, Raymond; Moineau, Hervé; Heizmann, J. Julien.** Topotactical relationships between hematite α-Fe_2O_3 and the magnetite Fe_3O_4 which is formed on it by thermal decomposition under low oxygen pressure, *in* Advances in X-ray analysis, V. 11—Applications of X-ray Analysis, 16th Ann. Conf., Denver, 1967, Proc.: New York, Plenum Press, p. 473–481, illus., tables, 1968.

The present work was performed on natural monocrystals from Mexico. All crystals presented well-formed natural faces of indices (01.2), (01.4), (11.3), and (00.1). They are reduced to magnetite in a thermobalance by heating at 1200°C under a pressure of 10^{-3} torr. The techniques used in the present work were Laué reflection diagrams and pole figures. The magnetite formed on the hematite showed preferential orientations of three different types. The mutual orientations of the two oxides all present a common zone axis for the lattices formed by the oxygen ions.—Authors' abstract

06106 **Barrow, Thomas D.** Oil and gas extraction technology, *in* Mineral resources of the world ocean—Symposium, Newport, R.I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, p. 56–65, illus., 1968.

Technology of exploiting petroleum resources of the U.S. continental margin is discussed under the topics: offshore exploration, including geophysical techniques, bottom sampling, and underwater geologic mapping; exploratory and development drilling and production; and financial aspects of exploration and development. Exploration of the Atlantic continental margin is in its beginning stages. Although no offshore wells have been drilled on the U.S. portion, geologic evidence indicates

potential for the Atlantic province; its estimated volume of sediments compares favorably with the known volume in the western Gulf basin, and the age and facies are similar to those of producing formations in the Gulf basin. The program is outlined for the 1967 investigation of the Atlantic continental slope by an oil company.—VMJ

Bassett, William A. *See* Mao, Ho-Kwang. 00061

06182 **Bauer, Max.** Precious stones—A popular account of their characters, occurrence, and applications, . . . *with a new foreword and addenda* by Edward Olsen—V. 1–2: New York, Dover Publications, 627 p., illus., 1968; originally published 1904.

The original German edition, *Edelsteinkunde*, was published in 1896; Bauer's chemical classification of gems is still used today. The first main section deals with the general characteristics of gem minerals; the only major addition here would be a discussion on arrangements of atoms within crystals and relation between geometry of the atomic arrays and external physical properties of minerals. The second section is a systematic descriptive treatment of precious minerals that includes some history, lore, and memorabilia. The third section treats the determination and distinguishing of precious stones; an appendix covers pearls and coral. The number of amendments, additions, and corrections seemed too small to warrant revising the entire manuscript, so an addenda was added to make the book more useful.—MCM

00288 **Beerbower, James R.** Skeletal evolution and the Cambrian–Precambrian boundary [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 3, 1969.

06183 **Beerbower, James R.** Search for the past—An introduction to paleontology (2d edition): Englewood Cliffs, N.J., Prentice-Hall, 512 p., illus., tables, 1968; originally published 1960.

New sections added to this text—systematics, morphology, ecology, and evolution of major invertebrate taxa—follow with few exceptions the *Treatise on invertebrate paleontology*. Material and presentation are somewhat more advanced than in the first edition. Chapter headings are: fossils and science; shape of yesterday; ordering of life; species; organic web; evolution; patterns of evolution; fossils and stratigraphy; ancestors and cousins; jellyfish and the coral; a step upward—Bryozoa; segments—Annelida; jointed limbs—Arthropoda; some that crawled—chitons, snails, and clams; to correlate—Cephalopoda; arms, stems, and spines—Echinodermata; brothers under the skin—Protochordata; coming of the vertebrates—fish and amphibians; victory on land—reptiles; and ascendancy of birds and mammals. Glossaries and references are given for each chapter, and there is a comprehensive index.—MCM

06308 **Behrens, E. William.** Cyclic and current structures in a serpulid reef: Contr. Marine Sci., v. 13, p. 21–27, illus., 1968.

Individual serpulid worm tubes are known from Ordovician to Recent, and reeflike colonies from Cretaceous to Recent. The present study of the ecology of living serpulids should be useful in interpreting paleoecology and structure of the fossil reefs. Reeflike growth of a common serpulid, *Hydroides norvegica*, was observed in concrete water-intake tunnels of a power plant in Corpus Christi harbor, Tex. As in natural reefs, growth is in annual cycles; each spring a new generation crowds out the old by its initial rapid growth rate. The tubes are randomly oriented at the beginning of the cycle, and later grow perpendicular to the substrate. The reef surface is rippled, and tubes within the ripples are strongly current oriented.—VMJ

00172 **Bell, James M.** Deformation of sand in shear—Discussion [of paper 5470 by H.-Y. Ko and R. F. Scott, 1967]: Am. Soc. Civil Engineers Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 340–341, 1969.

Ko and Scott's treatment of failure versus yield (ibid., v. 93, no. SM 5, pt. 1, p. 283–310, 1967), could be clarified physically if discontinuities in the stress deformation curves (referred to as failure) actually represented occurrence of measurable local yielding very close to the spacing frame. In this light, the

discontinuities are regarded simply as a result of stress concentration and would certainly not reflect a true stress–strain characteristic of sand. Related qualitative conclusions reached by the authors are interesting but speculative. Their recent attempts to better define stress–strain characteristics of a particular Ottawa sand are commendable. The newly developed stress control device seems well suited to the task, the soil test box does not.—ESL

06328 **Belousov, V. V.** An open letter to J. Tuzo Wilson, *in* Debate about the Earth: Geotimes, v. 13, no. 10, p. 17–19, 1968.

Six points of disagreement are raised with Wilson's "Revolution in the earth sciences" (ibid., p. 10–16, 1968). The first points out that Wilson ignored the contraction hypothesis, and Tetyayev's geotectonics. The second is a warning to those in a hurry to rewrite textbooks because the foundation of the contraction hypothesis has collapsed. In the third place, Belousov says that the theory Wilson is supporting has no foundation to start with, and proof is lacking that convection currents exist; inconsistencies in current directions are shown. Point 4 indicates a number of unanswered questions, and point 5 cites studies by Russian geologists that have been ignored. Geomagnetic data are the only real support of Wilson's theory, and some of them are inconsistent. Both the theory of continental drift and the concept of spreading ocean floor could serve as working hypotheses.—ESL

06307 **Bennett, J. M.; Smith, J. V.** Positions of cations and molecules in zeolites with the faujasite-type framework—[Pt.] 3, Hydrated Ca-exchanged faujasite: Materials Research Bull., v. 3, no. 12, p. 933–940, tables, 1968.

Only one-third of the electron density of the non-framework atoms was located in hydrated Ca-exchanged faujasite at room temperature. The electron density in the super-cage is mostly smeared out, as expected from other evidence for rapid movement of water molecules. Well-defined peaks at S(I′) and S(II′) are explained most simply by Ca in S(I′) bonded to O(3) and to H_2O in S(II′), but other arrangements are possible. A peak at S(V) probably, and a peak at S(II*) may represent hydrated Ca ions. The wide dispersion of ions and molecules explains why the alumino-silicate framework is more regular than in the dehydrated form. The terms "liquid" and "brine" are too simple for the complex variation of bonding between ions and molecules.—Authors' abstract

06049 **Ben-Yaakov, S.; Kaplan, I. R.** *p*H-temperature profiles in ocean and lakes using an *in situ* probe: Limnology and Oceanography, v. 13, no. 4, p. 688–693, illus., table, 1968.

An oceanographic pH probe recently developed and laboratory tested at UCLA (Ben-Yaakov and Kaplan, 1968) consists of four sensors—a transducer for pressure, a thermistor for temperature, a glass electrode, and a silver-silver chloride reference electrode with liquid junction for pH—connected to an electronic system for recording at the surface. The probe was used successfully to a depth of 700 m for direct measurement of pH-temperature profiles of sea water and sediment-water interface off the coast of southern California and in San Francisco Bay, and also in Salton Sea and Lake Arrowhead. Temperature, dissolved oxygen, and pH decrease with depth, showing close similarity in profile pattern; carbonate alkalinite (not measured) probably has an inverse relationship.—VMJ

Berner, Robert A. *See* Rhoads, Donald C. 06048

Berry, W. B. N. *See* Boucot, Arthur J. 05894

06114 **Berry, W. B. N.; Boucot, A. J.** Continental development from a Silurian viewpoint, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 3, Orogenic belts: Prague, Academia, p. 15–23, illus., 1968.

Lithofacies patterns plotted from correlation charts for the world Silurian have led to the following conclusions: (1) Continental growth by accretion since the Cambrian is inconsistent with available data. (2) Africa, Europe, the Near East, and probably Asia have acted as a single unit since the beginning of the Cambrian. (3) Early Paleozoic platform deposits adjacent to the present oceans on all continents

except North America lead to the suggestion that either large portions of these platforms have been submerged or continental drift may have occurred. (4) Major differential vertical movements of post-early Paleozoic age have been the chief factors in determining locations of the younger geosynclines and mountain belts.—KAF

06041 **Beyer, Paul J. N.** Chemical alteration of slate belt xenoliths in a granodiorite stock, Orange County, North Carolina [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4, p. 438, 1968.

Bickford, M. E. *See* Thomas, B. R. 00206

05908 **Biggs, Charles A.; McGregor, Alexander A.** The Bell Creek oil field, Powder River and Carter Counties, Montana, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 47–58, illus., 1968.

The Bell Creek field is a stratigraphic trap developed at or near the strand line of a transgressive Early Cretaceous sea. Flood plain, channel, and deltaic deposits were reworked and redeposited in a bar and beach environment. The updip limit of the overall reservoir is formed by a lateral facies change from porous and permeable sand to lagoonal clays, siltstone, and silty carbonaceous shales. Four and probably more individual reservoirs are present. Small updip gas caps and downdip water are present in most if not all of the reservoirs. Regional studies indicate that similar conditions should be present over a broad area of eastern Wyoming, southeastern Montana, and North and South Dakota.—HRC

Biggs, Charles A. *See* McGregor, A. A. 05996

06116 **Bird, Samuel O.** Lyell and the binomial distribution [abs.]: Virginia Jour. Sci., v. 19, no. 3, p. 193, 1968.

05997 **Bisque, Ramon E.** The explosion in geological education and its future effect on the profession [abs.]: Corpus Christi Geol. Soc. Bull., v. 9, no. 4, p. 2–3, 1968.

00071 **Blackwell, David D.** Heat-flow determinations in the northwestern United States: Jour. Geophys. Research, v. 74, no. 4, p. 992–1007, illus., tables, 1969.

Eleven new heat-flow determinations in the northwestern United States suggest a heat-flow pattern similar to that observed in the southwestern United States. In particular the high heat flow found in the Basin and Range province, about 2.0 μ cal per sq cm sec, is characteristic of the Northern Rocky Mountains province and possibly the Columbia Plateaus as well. Most of central Wyoming, central Montana, and western Washington may have normal heat flow. A heat-flow determination in the Black Hills is high. The Northern Rocky Mountains and Basin and Range provinces have similar regional heat flow, crustal structure, upper mantle P_n velocity, and Cenozoic geologic history. Thus, tectonic schemes that emphasize the Basin and Range province as a unique area on the North American continent must be reevaluated.—*from* Author's abstract

06134 **Blakely, Robert F.; Potter, Paul Edwin.** A program for generation of synthetic stratigraphic sections: Brigham Young Univ. Geology Studies, v. 15, pt. 1, p. 3–12, illus., tables, 1968.

This report contains a simple computer program for the generation of synthetic stratigraphic sections. To generate a stratigraphic section, a transition procedure to go from one lithology to another is needed, plus the thickness distributions of the different lithologies. Dependent Markovian processes define the transition procedure. Several examples illustrate the program [an algorithm, such as might define a quartzose sandstone body of fluvial origin, synthesizing four sedimentary structures plus mudstone, with provision to reduce or expand bed thickness].—Authors' abstract

05940 **Bloom, Arthur L.** Postglacial stratigraphy and morphology of central Connecticut, Trip A–1 *in* Guidebook for field trips in Connecticut—New England

Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 7 p., paged separately, illus., table, reprinted 1968; originally published 1965.

Three significant paludal environments—estuarine fresh-water marsh, former deep bay or lagoon, and shallow coastal marsh—wherein the interaction of sedimentation and submergence has resulted in three distinct stratigraphic records can be distinguished along the Connecticut coast. Examples described for this field trip are, respectively, Quinnipiac Valley near Hamden, Hammock River marsh near Clinton, and Chittenden Beach near Guilford. Positions and radiocarbon dates of peat from the deep bay or lagoon environment are included; ages range from 910 to 11,000 yr B.P.—HRC

06010 **Blount, D. N.** (compiler). Mapa geológico de Guatemala—Chiantla (Hoja 1962 IIIG): Guatemala City, Guatemala, Inst. Geográfico Nacional, scale 1:50,000, 1968.

06327 **Bolt, Bruce; O'Neill, M.; Qamar, A.** Seismic waves near 110°—Is structure in core or upper mantle responsible?: Royal Astron. Soc. Geophys. Jour., v. 16, no. 5, p. 475–487, illus., tables, 1968.

Observations of longitudinal waves at distances between 105° and 115° some minutes after the arrival of the P waves diffracted by the mantle-core boundary show: (1) that discernible PKiKP waves with wavelengths of the order of 10 km are reflected from the boundary of the Earth's inner core back to distances of at least 105°, and (2) that many longitudinal wave onsets having traveltimes up to 60 s before PKiKP and 90 s before PP arrive near 110° by means of reflection from the lower side of physical discontinuities in the upper mantle of the Earth. Results are consistent with a sharp increase in P velocity between the transition zone and the inner core at a radius of about 1220 km. Results suggest the existence of a number of discrete shells of different elastic properties in the Earth's upper mantle above 400 km.—*from* Authors' summary

06184 **Bolton, Thomas E.** Catalogue of type invertebrate fossils of the Geological Survey of Canada, V. 4: Ottawa, Geol. Survey Canada, 221 p., 1968.

The format of Volume 4 is similar to that adopted for the previous three volumes. Representatives of all phyla described subsequent to mid-1959, not included in Volumes 1–3, are listed in the present catalog. Some earlier described types, either refigured or recently located in the Survey collections, are recorded also. Primary type categories and secondary type terms are used with the same connotations.—GDC

06170 **Bonham-Carter, Graeme; Harbaugh, John W.** Simulation of geologic systems—An overview, *in* Computer applications in the earth sciences—Colloquium on simulation: Kansas Geol. Survey Computer Contr. 22, p. 3–10, illus., 1968.

Systems philosophy provides the theoretical framework linking diverse applications of computer simulation. Natural systems and man-made systems may be regarded as end members of a spectrum of system types. Simulation of man-made systems employs operations research techniques; the objectives of simulation are to optimize system design, and to test the performance of models under differing parameter settings. Simulation of natural systems cannot readily utilize specialized simulation languages, as these are designed primarily for industrial and business applications. The objectives of simulating natural systems are normally to test alternative models and to see how they react under various conditions: the natural system itself cannot be changed (unless it is partly man-influenced), only the model. [A delta is used as an example of a natural system; mining would be a man-made system].—Authors' abstract

Borst, George. *See* Nettleton, Wiley D. 06077

Bothner, W. A. *See* Gaudette, H. E. 00213

Bottino, M. L. *See* Dietrich, R. V. 00102

Bottino, Michael L. *See* Fullagar, Paul D. 06054

Boucot, A. J. *See* Harper, Charles W., Jr. 00106

00208 **Boucot, A. J.; Johnson, J. G.** Position of the Siluro-Devonian boundary in the Appalachian province [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 4, 1969.

Boucot, A. J. *See* Berry, W. B. N. 06114

05894 **Boucot, Arthur J.; Berry, W. B. N.; Johnson, J. G.** The crust of the Earth from a lower Paleozoic point of view, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 208–225, illus; discussion, p. 225–228, 1968.

Correlation of Silurian lithofacies throughout the world controverts the theory of continental growth by accretion, lends some support but does not prove continental oceanization or continental drift, and favors the conclusion that differential vertical movements since the Silurian have been responsible for the location of geosynclines and mountain belts on Cambro-Silurian platforms. Silurian brachiopod faunas are characterized by a taxonomically cosmopolitan condition, whereas early Devonian brachiopod faunas exhibit a highly provincial character. The data are not sufficient to determine whether the latitudinal component was significant in defining the early Devonian zoogeographic provinces and are therefore not diagnostic for either polar wandering or continental drift.—MS

05868 **Bowles, C. Gilbert.** Theory of uranium deposition from artesian water in the Edgemont district, southern Black Hills, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 125–130, illus., 1968.

Calcium-sulfate ground water carries uranium, derived from anhydrite and other sources, up fault, fracture, and breccia pipe structures to the Inyan Kara Group (Cretaceous) where, during basinward migration, the water is modified by base-exchange softening and sulfate reduction. Uranium is reduced and precipitated by a hydrogen sulfide environment, although, locally, organic acids may have affected deposition. Greatest precipitation occurs marginal to bicarbonate water having a large concentration of H_2S. Uranium from the older deposits in the Inyan Kara Group may be leached at higher elevations and reprecipitated downdip in this favorable environment. The coincidence of vertical pipes below evaporites would be a good exploration possibility if favorable host rocks were nearby.—HRC

06185 **Bowles, Joseph E.** Foundation analysis and design: New York, McGraw-Hill Book Co., 659 p., illus., tables, 1968.

This textbook presents material on the soils engineering and structural design aspects of various types of substructures. Many theories have been condensed, but pertinent references to them are cited. A generous number of examples are presented, some of which compare methods or theories where more than one may be used. Material, ranging from simple to very complex, is sufficient for two three-semester hour courses. Chapter headings of interest to geologists are: elements of soil mechanics; soil-bearing capacity, load-induced pressures, and settlements; soil exploration and sampling; lateral earth pressure; and soil dynamics.—MCM

06158 **Bowman, John R.; Holliday, Barry W.; Johnson, Gerald H.; Rohr, David M.** The origin and development of a coquina facies of the Yorktown Formation near Chuckatuck, Va. [abs.]: Virginia Jour. Sci., v. 19, no. 3, p. 194, 1968.

06188 **Bowser, Carl J.; Gates, Robert M.; Archbald, David.** Quick-key guide to rocks and minerals: Garden City, N.Y., Doubleday and Co., [157] p., illus., 1968.

The guide, designed to enable a person with no knowledge of rocks and minerals to identify the common ones, is made up of two books; the first, with sections on rocks and on minerals, can be used separately. The mineral section contains

48 cards of identifiable characteristics for 121 minerals. The second book is composed of punched cards for color, texture, etc., with rock or mineral names by holes. These are used over a black card to indicate two or three possibilities from which the correct one can be selected from the descriptions in the first book.—ESL

05928 **Bradley, W. F.** Memorial of Eriol Joseph Weiss (March 18, 1918–June 14, 1967): Am. Mineralogist, v. 53, nos. 3–4, p. 617–619, portrait, 1968.

Bramlette, M. N. *See* Bukry, David. 06348

06167 **Branson, Carl C.** Chester A. Reeds, Oklahoma geologist [1882–1968]: Oklahoma Geology Notes, v. 28, no. 6, p. 192–194, portrait, 1968.

Bratt, J. M. *See* Swain, F. M. 06304

00065 **Brent, Millard D.; Sandidge, John R.** Uranium production in south-central Texas: Prof. Geographer, v. 21, no. 1, p. 15–17, 1969.

Uranium, discovered in 1954 in the western Gulf Coastal Plain of Texas, is now produced from Tertiary strata in areas of faulting in Karnes and Live Oak Counties. Petroleum and natural gas, produced from older formations in the same faulted area, may have provided a precipitating environment for the uranium minerals that were originally associated with volcanic tuffs. A lignite layer stratigraphically above the productive zone, is sufficiently radioactive so as to warrant mining and processing at one mine in Karnes County. The history of production is reviewed.—LLR

00110 **Bretsky, Peter W.** Central Appalachian Late Ordovician communities: Geol. Soc. America Bull., v. 80, no. 2, p. 193–212, illus., tables, 1969.

Fossiliferous beds at the top of the Reedsville and Martinsburg Formations, including the classic *Orthorhynchula* Zone, provide one of the earliest known examples of a prolific nearshore, clastic-facies fauna that contains species of distinctly modern aspect. About 35 abundant fossil species dominate the fauna; these are mostly bryozoans, brachiopods, gastropods, and bivalve mollusks, with some trilobites and crinoids. Three distinct faunal communities are recognized on the basis of species which occur together: (1) The *Sowerbyella–Onniella* Community lived on muddy silt bottoms of the outer infralittoral. (2) The *Orthorhynchula–Ambonychia* Community lived on sand–silt bottoms of the inner infralittoral and intertidal. (3) *Zygospira–Hebertella* Community lived on mud and silty mud bottoms of the inner and outer infralittoral.—AKA

Bricker, Owen P. *See* Cleaves, Emery T. 00209

05892 **Briden, James C.** Paleoclimatic evidence of a geocentric axial dipole field, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor) Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 178–194, illus., tables, discussion, 1968.

Models of paleolatitudes derived from the latitude-dependent distribution of faunas, floras, and sedimentary rocks lend support to the hypothesis that the Earth's magnetic field has been close to that of a geocentric axial dipole since Cambrian time.—MS

06100 **British Columbia Minister of Mines.** (and Petroleum Resources). Annual report for the year ended December 31, 1967: Victoria, B.C., British Columbia Dept. Mines and Petroleum Resources, [586] p., illus., tables, 1968.

This report includes a review of the mineral industry, statistics, departmental work, topographic mapping and air photography, and work of the Canada Department of Energy, Mines and Resources in British Columbia. The section on lode metals contains a general review of metal mining and exploration, notes on metal mines in the named mining divisions of the province, and a list of geological, geophysical, and geochemical reports credited for assessment work on mineral claims or placer

leases. Separate sections cover placer mining, structural materials and industrial minerals, petroleum and natural gas, and coal.—MCM

06337 **Brooke, John; Gilbert, R. L. G.** The development of the Bedford Institute deep-sea drill: Deep-Sea Research, v. 15, no. 4, p. 483–490, illus., 1968.

A new concept for drilling short cores of rock from the floor of the deep ocean is described. The power for operating the drill is obtained from water which moves from the normal ambient hydrostatic pressure into a low pressure void. A general description is given of the complete drill assembly and its method of operation. The results of three series of experiments at sea, and of a number of tests on land are given, from which the abilities and limitations of the drill in its present form may be inferred. The plans for future work are described and long-range objectives are outlined.—Authors' abstract

06063 **Brooker, E. W.; Scott, J. S.; Ali, Physool.** A transducer piezometer for clay shales: Canadian Geotech. Jour., v. 5, no. 4, p. 256–264, illus., table, 1968.

This highly sensitive diaphragm-type transducer piezometer has been successfully applied for measuring ground-water fluctuations in Cretaceous shales of western Canada and the United States. The instrument, its transducer characteristics, and installation are described. Results obtained at localities in Saskatchewan, Alberta, and Prince Edward Island are shown in graphs.—ESL

06102 **Brooks, David B.; Lloyd, Barbara S.** Mineral economics and the oceans, *in* Mineral resources of the world ocean—Symposium, Newport, R.I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, p. 23–30, illus., 1968.

Supply and demand conditions for minerals are projected to the year 2000 for the world and the U.S., and are discussed specifically for manganese, nickel, sulfur, and phosphorus, which might be recovered economically from the oceans. Present reserves of the first three are exhaustible, so that the economic outlook for mining of deep-sea Mn-Ni nodules and offshore sulfur deposits is promising. Phosphorus reserves far exceed any anticipated demand, but some economic factors might favor offshore mining. The oceans, however, are only one of the potential sources for all these commodities; economic feasibility of ocean vs. land mining is discussed in relation to national security, regional economics, industrial structure, research spillover, land conflicts, and pollution.—VMJ

05970 **Brophy, Gerald P.; Nash, J. Thomas.** Compositional, infrared, and X-ray analysis of fossil bone: Am. Mineralogist, v. 53, nos. 3–4, p. 445–454, illus., tables, 1968.

Fossil bone exhibits an increase in F over modern mammalian bone, but CO_2 and H_2O are essentially the same. Heating fossil bone, modern bone, and carbonate-bearing apatites to 1250°C produces no separate CaO phase detectable by X-ray diffraction, but Na is subsequently leached preferentially. Infrared spectrograms provide no evidence of physically discrete CO_2-bearing phases in carbonate-bearing apatites and fossil bones. The carbonate-vibration in the 7 micron region shows a bidentate or tridentate split, suggesting that two carbonate sites exist, one of which is asymmetrical. The model of McConnell (1960) for carbonate apatites fits these data most closely.—*from* Authors' abstract

00278 **Buehler, Edward J.** Middle Devonian epizooites [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 4, 1969.

Buffington, Edwin C. *See* Scholl, David W. 06122

06348 **Bukry, David; Bramlette, M. N.** Stratigraphic significance of two genera of Tertiary calcareous nannofossils: Tulane Studies Geology, v. 6, no. 4, p. 149–155, illus., 1968.

A new species of calcareous nannoplankton, *Ceratolithus rugosus*, is described, and emended descriptions of *C. cristatus* and *C. tricorniculatus* are presented. The

worldwide occurrence [samples from 24 localities, including Gulf Coastal Plain of Ala. and Miss., southern France and Italy, and deep-sea cores of Atlantic, Pacific, and Indian Oceans] and partial overlap in the sequence of ranges of these taxa are helpful in age assignments of late Miocene to Holocene strata. A new species, *Peritrachelina joidesa*, of late Eocene to middle Oligocene age is also described.—Authors' abstract

05887 **Bullard, E. C.** Conference on the history of the Earth's crust, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 231-235, 1968.

Rather than the history of continental folded mountains, emphasis of the conference held at the Goddard Institute for Space Studies in November 1966 was focused on the history of oceans and midoceanic ridges and the division between continents and oceans. Field reversals established from lavas on land, recognition of the same reversals in oceanic sediments, and the magnetic patterns on the ocean floor represent three independent lines of evidence for a sequence of field reversals that serves as a basis for interpreting the velocity of sea-floor spreading, rates of sedimentation, and other developments in the history of the Earth's crust. The mechanism of crustal movements is not yet fully known; convection in the mantle seems the most likely explanation.—MS

Buol, S. W. *See* Khalifa, E. M. 05964

06113 **Burchfiel, B. C.; Davis, G. A.** Two-sided nature of the Cordilleran orogen and its tectonic implications, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 3, Orogenic belts: Prague, Academia, p. 175-184, illus., 1968.

Contrary to common ideas concerning North American geology, the Cordilleran orogenic belt in the western United States appears to be bilaterally symmetrical with respect to Mesozoic and early Tertiary thrust faulting. The presence of bilateral symmetry for Paleozoic thrusting cannot be established at the present time. Thrust faults in the orogen decrease in age toward its eastern and western margins. Within the orogenic belt a central terrain of variable tectonic style can be defined between adjacent zones of divergent westward and eastward thrust movements. The geometry observed and inferred for Cordilleran thrust faults leads to the conclusion that large-scale crustal shortening has taken place across the orogen. Large amounts of crustal material have moved downward, a phenomenon probably best explained by the hypothesis of converging subcrustal convection cells.—*from Authors' abstract*

05922 **Burger, H. Robert; Hewitt, David A.; Vidale, Rosemary J.** Progressive metamorphism of pelitic, carbonate, and basic rocks in south-central Connecticut, Trip D-1 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 19 p., paged separately, illus., table, 1968.

The rocks of this immediate area consist of an assortment of metamorphosed shales, graywackes, basic volcanics, and minor amounts of carbonates and sandstones; they range in age from Cambrian to Devonian and have been metamorphosed from the chlorite to the kyanite zone. Fifteen stops on a field trip are described, each at a different phase of this classic example of Barrovian metamorphism.—HRC

06131 **Burke, John C.** A sediment coring device of 21-cm diameter with sphincter core retainer: Limnology and Oceanography, v. 13, no. 4, p. 714-718, illus., 1968.

This corer was developed to provide large cross section core samplers for analysis of fallout radionuclides in sediments of Crater Lake, Oreg. Study of vertical profiles of concentration of the radionuclides requires in-place recovery of the topmost layers of sediment, which are commonly lost by conventional samplers from washout or impact shock wave. A variety of sediment types, ranging from very soft muds to coarse sands must be efficiently retained. The new device, combining large diameter with watertight closing, meets all these requirements. The corer performed satisfactorily in preliminary tests and in the operation at Crater Lake, where five

cores were taken, 25 to 75 cm long in depths from 400 to 589 m; much longer cores should be possible with increase in weight and speed of entry.—VMJ

00075 **Burke, W. H.; Otto, J. B.; Denison, R. E.** Potassium–argon dating of basaltic rocks: Jour. Geophys. Research, v. 74, no. 4, p. 1082–1086, illus., table, 1969.

To evaluate the reliability of K–Ar ages on fresh basaltic rocks, various fractions and whole rocks were dated. The samples were chosen to obtain a variety of petrographic types representing several petrologic kindred and cooling environments. The dates provided no evidence of argon leakage. One sample of an unusual rock type (a troctolite) gave an anomalously high age, suggesting excess radiogenic argon. Nepheline separates from two rocks yielded ages equivalent to the ages of biotite and pyroxene.—Authors' abstract

Burke, William H., Jr. *See* Denison, Rodger E. 00052

06050 **Burn, K. N.; Hamilton, J. J.** Settlement of an embankment on Leda clay [with French abs.]: Canadian Geotech. Jour., v. 5, no. 1, p. 16–27, illus., tables, 1968.

Before construction, standard consolidation tests indicated that the stresses imposed by a high embankment on a deep and relatively homogeneous deposit of Leda clay [Ottawa, Ontario] would exceed the preconsolidation stress and result in settlements of up to 18 in. Later, the results of more refined sampling and testing methods showed that the preconsolidation pressure had been underestimated by 1 ton/sq ft and that the imposed stresses would in fact fall within the recompression range. Time–settlement relationships, however, were not elastic; vertical strains continued to increase long after the embankment was completed. Field measurements of settlement are compared with values computed using compression moduli determined both from consolidation and compression tests in the laboratory.—Authors' abstract

00133 **Burst, John F.** Diagenesis of Gulf Coast clayey sediments and its possible relation to petroleum migration: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 73–93, illus., table, 1969.

During diagenesis pore water and interlayer water of clay minerals are expelled in three stages as a result of both pressure and heat absorption. The migration of this water through the formation porosity alters the distribution of all mobile constituents including petroleum. The temperature dependent second stage of the dewatering process probably initiates petroleum migration into suitable traps, and geothermal gradient maps and clay dehydration contour maps may aid in determining areas and depths of petroleum traps.—SEF

00077 **Busby, Roswell F.** Ocean surveying from manned submersibles: Marine Technology Soc. Jour., v. 3, no. 1, p. 11–24, illus., 1969.

Although a wide variety of tasks have been performed, the manned submersible is still too new a tool to have firmly established its role in oceanographic/engineering surveys. It is indicated that the following missions could benefit most through its use: site surveys, verification of surface-obtained data, route selection surveys, biological surveys, and geological surveys of sediments, structures, and processes. Sufficient observations from submersibles exist to indicate that surface conducted surveying, alone, may produce an erroneous impression. Echo sounding in the Bahamas missed near-vertical cliffs 3 to 150 m high, observed from submersibles. Variation in near-bottom current speeds, and abrupt changes in bottom sediment grain sizes are better detected from submersibles.—*from* Author's abstract

00139 **Buzas, Martin A.; Gibson, Thomas G.** Species diversity—Benthonic foraminifera in western North Atlantic: Science, v. 163, no. 3862, p. 72–73, illus., 1969.

Maximum species diversity occurs at abyssal depths of greater than 2500 m. Other diversity peaks occur at depths of 35 to 45 m and 100 to 200 m. The peak at 35 to 45 m is due to species equitability, whereas the other two peaks correspond to an increase in the number of species.—Authors' abstract

06018 **Cailleux, André.** Anatomy of the Earth (translated from French): New York, McGraw-Hill Book Co. (World University Library), 251 p., illus., tables, 1968.

This well illustrated book presents a general introduction to the Earth's external and internal features, its history, and its place in the whole universe. Chapter headings are: Earth's external form, Earth's interior, anatomy of the Earth's crust, chemical constitution of the Earth, the Earth's origin, movement of the continents, mountain building, and the future. The chapter on movement of the continents attempts to give an impartial outline of the main arguments for and against the theories of movements of continents and continental drift in the light of generally accepted scientific opinion. The final chapter explains the part that satellites and deep drillings are beginning to play in the study of anatomy of the Earth.—MCM

06179 **California Dept. Water Resources.** Hydrologic data, 1967—V. 1, North coastal area: California Dept. Water Resources Bull. 130-67, 79 p., illus., tables, 1968.

The report contains tables showing data on climate, surface-water flow, ground-water levels, and surface- and ground-water quality in the area during the 1966-67 water year. There are nine ground-water basins in the region for which data are reported; data were collected also from 27 stream stations. Mineral and trace-element analyses are tabulated for both surface and ground water.—ESL

00279 **Calkin, Parker E.; McAndrews, John H.** Dating late glacial recession and vegetation in the Erie basin, northwestern New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 5, 1969.

00120 **Cameron, Barry.** New name for *Palaeosabella prisca* (McCoy), a Devonian worm-boring, and its preserved probable borer: Jour. Paleontology, v. 43, no. 1, p. 189-192, illus., 1969.

The new name *Vermiforichnus clarkei* n.gen. n.sp. is proposed for worm-borings in pelecypod shells in the Middle Devonian Marcellus Shale of central New York. The name *Palaeosabella prisca* (McCoy) was mistakenly applied to these borings by Clarke (1921), but the generic name was later designated a junior subjective synonym of *Topsentia* Clarke, 1921, a Paleozoic sponge-boring. A specimen of the soft-bodied polychaete annelid that may have made the borings was found in one of them and described by Cameron (1967); the name *Vermiforafacta rollinsi* n.gen n.sp. is here proposed for the worm. Two names are warranted because of questionable relationship between worm and boring and because criteria for defining species of body fossils are somewhat different from those for trace fossils.—VMJ

00280 **Cameron, Barry.** Stratigraphy of Rocklandian State (Middle Ordovician Trentonian Series) in northwestern New York and southeastern Ontario [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 5-6, 1969.

00281 **Cameron, Cornelia C.** Reflection of bedrock geology in peat ash of southeastern New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 6, 1969.

06052 **Campbell, Ian.** Earth scientists and political scientists need each other, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 12, Engineering geology in country planning: Prague, Academia, p. 19-27, 1968.

Geology is emerging as a science with extensive application in urban areas. The "need to know" and the "need to heed" the facts of geology are nowhere better demonstrated than in California. The demands of growing populations for mineral resources are worrying planners lest areas of the most favorable deposits be urbanized before resources can be extracted. Reaction to this "need to know," whether directed to "geological hazards" or minerals, ranges from the *laissez faire* of some to the deep concern of the better informed citizens, public oficials, and lawmakers. The most important and the most challenging problem is that of bridging the "sophistication gap".—*from* Author's abstract

Campbell, Lyle. *See* Kauffman, Marvin E. 00218

05990 **Canada Dept.Energy,Mines and Resources; Canada Geological Survey.** Principal mineral areas of Canada: Canada Geol. Survey Map 900A, 18th edition, scale 1:7,603,200, 1968.

The map sheet includes an index to principal producing areas, by province; graphs of mineral production for 1967 and from 1947-1967; a table of mineral production by provinces for 1967; and an index to principal oil and gas fields.—MCM

Canada Geological Survey. *See* Canada Dept.Energy,Mines and Resources.

06190 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 K/1 and 76 K/2, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3623, scale 1:63,360, 1968.

06191 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 J/3 and 76 J/4, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3624, scale 1:63,360, 1968.

06192 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 J/1 and 76 J/2, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3625, scale 1:63,360, 1968.

06193 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 I/3 and 76 I/4, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3626, scale 1:63,360, 1968.

06194 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 I/1 and 76 I/2, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3627, scale 1:63,360, 1968.

06195 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 K/5 and 76 K/6, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3628, scale 1:63,360, 1968.

06196 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 K/7 and 76 K/8, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3629, scale 1:63,360, 1968.

06197 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 J/5 and 76 J/6, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3630, scale 1:63,360, 1968.

06198 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 J/7 and 76 J/8, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3631, scale 1:63,360, 1968.

06199 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 I/5 and 76 I/6, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3632, scale 1:63,360, 1968.

06200 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 I/7 and 76 I/8, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3633, scale 1:63,360, 1968.

06201 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 K/11 and 76 K/12, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3634, scale 1:63,360, 1968.

06202 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 K/9 and 76 K/10, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3635, scale 1:63,360, 1968.

06203 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 J/11 and 76 J/12, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3636, scale 1:63,360, 1968.

06204 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 J/9 and 76 J/10, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3637, scale 1:63,360, 1968.

06205 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 I/11 and 76 I/12, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3638, scale 1:63,360, 1968.

06206 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 I/9 and 76 I/10, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3639, scale 1:63,360, 1968.

06207 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 K/13 and 76 K/14, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3640, scale 1:63,360, 1968.

06208 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 K/15 and 76 K/16, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3641, scale 1:63,360, 1968.

06209 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 J/13 and 76 J/14, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3642, scale 1:63,360, 1968.

06210 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 J/15 and 76 J/16, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3643, scale 1:63,360, 1968.

06211 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 I/13 and 76 I/14, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3644, scale 1:63,360, 1968.

06212 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 I/15 and 76 I/16, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3645, scale 1:63,360, 1968.

06213 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 N/3 and 76 N/4, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3646, scale 1:63,360, 1968.

06214 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 N/1 and 76 N/2, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3647, scale 1:63,360, 1968.

06215 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 O/3 and 76 O/4, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3648, scale 1:63,360, 1968.

06216 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 O/1 and 76 O/2, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3649, scale 1:63,360, 1968.

06217 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 P/3 and 76 P/4, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3650, scale 1:63,360, 1968.

06218 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 P/1 and 76 P/2, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3651, scale 1:63,360, 1968.

06219 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 N/5 and 76 N/6, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3652, scale 1:63,360, 1968.

06220 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 N/7 and 76 N/8, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3653, scale 1:63,360, 1968.

06221 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 K/4, Yukon Territory: Canada Geol. Survey Geophysics Paper 4352, scale 1:63,360, 1968.

06222 **Canada Geological Survey.** Aeromagnetic series, Rose Mountain, Yukon Territory: Canada Geol. Survey Geophysics Paper 4353, scale 1:63,360, 1968.

06223 **Canada Geological Survey.** Aeromagnetic series, Twopete Mountain, Yukon Territory: Canada Geol. Survey Geophysics Paper 4354, scale 1:63,360, 1968.

06224 **Canada Geological Survey.** Aeromagnetic series, Stokes Lake, Yukon Territory: Canada Geol. Survey Geophysics Paper 4355, scale 1:63,360, 1968.

06225 **Canada Geological Survey.** Aeromagnetic series, Plateau Mountain, Yukon Territory: Canada Geol. Survey Geophysics Paper 4356, scale 1:63,360, 1968.

06226 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 N/105, Yukon Territory: Canada Geol. Survey Geophysics Paper 4357, scale 1:63,360, 1968.

06227 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 N/12, Yukon Territory: Canada Geol. Survey Geophysics Paper 4358, scale 1:63,360, 1968.

06228 **Canada Geological Survey.** Aeromagnetic series, Penape Lake, Yukon Territory: Canada Geol. Survey Geophysics Paper 4359, scale 1:63,360, 1968.

06229 **Canada Geological Survey.** Aeromagnetic series, Buttle Creek, Yukon Territory: Canada Geol. Survey Geophysics Paper 4362, scale 1:63,360, 1968.

06230 **Canada Geological Survey.** Aeromagnetic series, Mount Mye, Yukon Territory: Canada Geol. Survey Geophysics Paper 4363, scale 1:63,360, 1968.

06231 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 K/11, Yukon Territory: Canada Geol. Survey Geophysics Paper 4364, scale 1:63,360, 1968.

06232 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 K/14, Yukon Territory: Canada Geol. Survey Geophysics Paper 4365, scale 1:63,360, 1968.

06233 **Canada Geological Survey.** Aeromagnetic series, Russell Creek, Yukon Territory: Canada Geol. Survey Geophysics Paper 4366, scale 1:63,360, 1968.

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06235 **Canada Geological Survey.** Aeromagnetic series, Lansing, Yukon Territory: Canada Geol. Survey Geophysics Paper 4368, scale 1:63,360, 1968.

06236 **Canada Geological Survey.** Aeromagnetic series, Seven Mile Canyon, Yukon Territory: Canada Geol. Survey Geophysics Paper 4369, scale 1:63,360, 1968.

06237 **Canada Geological Survey.** Aeromagnetic series, Swim Lakes, Yukon Territory: Canada Geol. Survey Geophysics Paper 4372, scale 1:63,360, 1968.

06238 **Canada Geological Survey.** Aeromagnetic series, Blind Creek, Yukon Territory: Canada Geol. Survey Geophysics Paper 4373, scale 1:63,360, 1968.

06239 **Canada Geological Survey.** Aeromagnetic series, Teddy Creek, Yukon Territory: Canada Geol. Survey Geophysics Paper 4374, scale 1:63,360, 1968.

06240 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 K/15, Yukon Territory: Canada Geol. Survey Geophysics Paper 4375, scale 1:63,360, 1968.

06241 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 N/2, Yukon Territory: Canada Geol. Survey Geophysics Paper 4376, scale 1:63,360, 1968.

06242 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 N/7, Yukon Territory: Canada Geol. Survey Geophysics Paper 4377, scale 1:63,360, 1968.

06243 **Canada Geological Survey.** Aeromagnetic series, Swan Lake, Yukon Territory: Canada Geol. Survey Geophysics Paper 4378, scale 1:63,360, 1968.

06244 **Canada Geological Survey.** Aeromagnetic series, Mount Ortell, Yukon Territory: Canada Geol. Survey Geophysics Paper 4379, scale 1:63,360, 1968.

06245 **Canada Geological Survey.** Aeromagnetic series, Husky Dog Creek, Yukon Territory: Canada Geol. Survey Geophysics Paper 4384, scale 1:63,360, 1968.

06246 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 N/8, Yukon Territory: Canada Geol. Survey Geophysics Paper 4385, scale 1:63,360, 1968.

06247 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 N/9, Yukon Territory: Canada Geol. Survey Geophysics Paper 4386, scale 1:63,360, 1968.

06248 **Canada Geological Survey.** Aeromagnetic series, Sheet 105 N/16, Yukon Territory: Canada Geol. Survey Geophysics Paper 4387, scale 1:63,360, 1968.

06249 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 O/5 and 76 O/6, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4547, scale 1:63,360, 1968.

06250 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 O/7 and 76 O/8, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4548, scale 1:63,360, 1968.

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06252 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 P/7 and 76 P/8, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4550, scale 1:63,360, 1968.

06253 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 N/11 and 76 N/12, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4551, scale 1:63,360, 1968.

06254 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 N/9 and 76 N/10, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4552, scale 1:63,360, 1968.

06255 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 O/11 and 76 O/12, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4553, scale 1:63,360, 1968.

06256 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 O/9 and 76 O/10, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4554, scale 1:63,360, 1968.

06257 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 P/11 and 76 P/12, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4555, scale 1:63,360, 1968.

06258 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 P/9 and 76 P/10, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4556, scale 1:63,360, 1968.

06259 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 N/13 and 76 N/14, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4557, scale 1:63,360, 1968.

06260 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 N/15 and 76 N/16, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4558, scale 1:63,360, 1968.

06261 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 O/13 and 76 O/14, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4559, scale 1:63,360, 1968.

06262 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 O/15 and 76 O/16, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4560, scale 1:63,360, 1968.

06263 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 P/13 and 76 P/14, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4561, scale 1:63,360, 1968.

06264 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 P/15 and 76 P/16, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 4562, scale 1:63,360, 1968.

06265 **Canada Geological Survey.** Aeromagnetic series, Lac Hulot, Quebec: Canada Geol. Survey Geophysics Paper 4941, scale 1:63,360, 1968.

06266 **Canada Geological Survey.** Aeromagnetic series, Lac Blanzy, Quebec: Canada Geol. Survey Geophysics Paper 4942, scale 1:63,360, 1968.

06267 **Canada Geological Survey.** Aeromagnetic series, Lac Bardoux, Quebec: Canada Geol. Survey Geophysics Paper 4995, scale 1:63,360, 1968.

06268 **Canada Geological Survey.** Aeromagnetic series, Lac Raudot, Quebec: Canada Geol. Survey Geophysics Paper 4997, scale 1:63,360, 1968.

06269 **Canada Geological Survey.** Aeromagnetic series, Lac Rond, Quebec: Canada Geol. Survey Geophysics Paper 5009, scale 1:63,360, 1968.

06270 **Canada Geological Survey.** Aeromagnetic series, Sept-Iles, Quebec: Canada Geol. Survey Geophysics Paper 5039, scale 1:63,360, 1968.

06271 **Canada Geological Survey.** Aeromagnetic series, Lac des Rapides, Quebec: Canada Geol. Survey Geophysics Paper 5040, scale 1:63,360, 1968.

06272 **Canada Geological Survey.** Aeromagnetic series, Rivière Vallée, Quebec: Canada Geol. Survey Geophysics Paper 5041, scale 1:63,360, 1968.

06273 **Canada Geological Survey.** Aeromagnetic series, Lac à l'Eau-Dorée, Quebec: Canada Geol. Survey Geophysics Paper 5042, scale 1:63,360, 1968.

06274 **Canada Geological Survey.** Aeromagnetic series, Lac Nipissis, Quebec: Canada Geol. Survey Geophysics Paper 5043, scale 1:63,360, 1968.

06275 **Canada Geological Survey.** Aeromagnetic series, Grand Lac au Sable, Quebec: Canada Geol. Survey Geophysics Paper 5044, scale 1:63,360, 1968.

06276 **Canada Geological Survey.** Aeromagnetic series, Lac Brochet, Quebec: Canada Geol. Survey Geophysics Paper 5045, scale 1:63,360, 1968.

06277 **Canada Geological Survey.** Aeromagnetic series, Lac Poissons-Blancs, Quebec: Canada Geol. Survey Geophysics Paper 5046, scale 1:63,360, 1968.

06278 **Canada Geological Survey.** Aeromagnetic series, Sheet 22 I/3, Quebec: Canada Geol. Survey Geophysics Paper 5073, scale 1:63,360, 1968.

06279 **Canada Geological Survey.** Aeromagnetic series, Rivière aux Graines, Quebec: Canada Geol. Survey Geophysics Paper 5074, scale 1:63,360, 1968.

06280 **Canada Geological Survey.** Aeromagnetic series, Lac Brézel, Quebec: Canada Geol. Survey Geophysics Paper 5075, scale 1:63,360, 1968.

06281 **Canada Geological Survey.** Aeromagnetic series, Lac Manitou, Quebec: Canada Geol. Survey Geophysics Paper 5076, scale 1:63,360, 1968.

06282 **Canada Geological Survey.** Aeromagnetic series, Lac à l'Aigle, Quebec: Canada Geol. Survey Geophysics Paper 5077, scale 1:63,360, 1968.

06283 **Canada Geological Survey.** Aeromagnetic series, Lac Vital, Quebec: Canada Geol. Survey Geophysics Paper 5078, scale 1:63,360, 1968.

06284 **Canada Geological Survey.** Aeromagnetic series, Lac Fournier, Quebec-Newfoundland: Canada Geol. Survey Geophysics Paper 5079, scale 1:63,360, 1968.

06285 **Canada Geological Survey.** Aeromagnetic series, Lac Fleur-de-May, Quebec-Newfoundland: Canada Geol. Survey Geophysics Paper 5080, scale 1:63,360, 1968.

06286 **Canada Geological Survey.** Aeromagnetic series, Sheet 22 I/2, Quebec: Canada Geol. Survey Geophysics Paper 5090, scale 1:63,360, 1968.

06287 **Canada Geological Survey.** Aeromagnetic series, Sheldrake, Quebec: Canada Geol. Survey Geophysics Paper 5091, scale 1:63,360, 1968.

06288 **Canada Geological Survey.** Aeromagnetic series, Lac à Renard, Quebec: Canada Geol. Survey Geophysics Paper 5092, scale 1:63,360, 1968.

06289 **Canada Geological Survey.** Aeromagnetic series, Lac de la Mine, Quebec: Canada Geol. Survey Geophysics Paper 5093, scale 1:63,360, 1968.

06290 **Canada Geological Survey.** Aeromagnetic series, Magpie Lake North, Quebec: Canada Geol. Survey Geophysics Paper 5094, scale 1:63,360, 1968.

06291 **Canada Geological Survey.** Aeromagnetic series, Lac Catignan, Quebec: Canada Geol. Survey Geophysics Paper 5095, scale 1:63,360, 1968.

06292 **Canada Geological Survey.** Aeromagnetic series, Sheet 22 P/10, Quebec-Newfoundland: Canada Geol. Survey Geophysics Paper 5096, scale 1:63,360, 1968.

06293 **Canada Geological Survey.** Aeromagnetic series, Lac Domagaya, Quebec-Newfoundland: Canada Geol. Survey Geophysics Paper 5097, scale 1:63,360, 1968.

06294 **Canada Geological Survey.** Aeromagnetic series, Ile de Mingan, Quebec: Canada Geol. Survey Geophysics Paper 5107, scale 1:63,360, 1968.

06295 **Canada Geological Survey.** Aeromagnetic series, Mingan, Quebec: Canada Geol. Survey Geophysics Paper 5108, scale 1:63,360, 1968.

06296 **Canada Geological Survey.** Aeromagnetic series, Lac Esnault, Quebec: Canada Geol. Survey Geophysics Paper 5109, scale 1:63,360, 1968.

06297 **Canada Geological Survey.** Aeromagnetic series, Lac Ternet, Quebec: Canada Geol. Survey Geophysics Paper 5110, scale 1:63,360, 1968.

06298 **Canada Geological Survey.** Aeromagnetic series, Rivière Poisset, Quebec: Canada Geol. Survey Geophysics Paper 5111, scale 1:63,360, 1968.

06299 **Canada Geological Survey.** Aeromagnetic series, Lac Verrier, Quebec: Canada Geol. Survey Geophysics Paper 5112, scale 1:63,360, 1968.

06300 **Canada Geological Survey.** Aeromagnetic series, Lac Bellanca, Quebec-Newfoundland: Canada Geol. Survey Geophysics Paper 5113, scale 1:63,360, 1968.

06301 **Canada Geological Survey.** Aeromagnetic series, Lac Thévet, Quebec–Newfoundland: Canada Geol. Survey Geophysics Paper 5114, scale 1:63,360, 1968.

05958 **Canadian Well Logging Society.** Second formation evaluation symposium, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., sections paged separately, illus., tables, 1968.

This volume contains papers presented at the Second Formation Evaluation Symposium of the Canadian Well Logging Society in Calgary, Alberta, on May 6–8, 1968. Some of the subjects covered are: computer analyses of logs, use of flame ionization detection, the Sidewall Neutron log, formation factor values, evaluation of fractured reservoirs, acoustic logging through casing, drill stem testing, and porosity–water saturation relationships applied to log analysis. Thirteen papers are cited separately.—KAF

06342 **Cannon, P. Jan.** Pleistocene stream piracy in southwestern Oklahoma: Oklahoma Geology Notes, v. 28, no. 6, p. 183–187, illus., 1968.

Recent work on terrace deposits indicates that the Salt Fork of Red River was once a tributary of the North Fork of the river. Three major levels of Pleistocene deposits occur, the highest being the oldest. South of Mangum the Salt Fork is devoid of middle-terrace deposits, indicating the piracy occurred after emplacement of these deposits. Lowering of base level by piracy resulted in rejuvenation of the pirated segment of Salt Fork. Capture of the Salt Fork also reduced substantially discharge of the North Fork. Evidence for such a change between middle- and lower-terrace times is found in stream-cut horizontal flutings on granite hills which face the North Fork.—ESL

00282 **Card, K. D.** Geology and geochronology of the Southern Province of the Canadian shield [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 6–7, 1969.

06075 **Carnaham, Veryle.** The minerals of L. A. County [Pt. 2]: Los Angeles County Mus. Nat. History Quart., v. 6, no. 4, p. 20–24, illus., 1968.

Mineral localities reported a century ago are yielding interesting and spectacular specimens today in Los Angeles County, Calif. In Part 1 of this account (1967), amygdaloidal basalt in which zeolites formed was described; these formations are hunted today in the Santa Monica Mountains, particularly Griffith Park. In old mines and claims of the San Gabriel Mts. rare and beautiful minerals have been found; those in a large gabbro pegmatite on the slopes of Pacoima Canyon are described. Titaniferous magnetite, occurrences of silver and sites of placer mining for gold are mentioned. Numerous occurrences of graphite in metamorphosed sedimentary rocks of the northern ridges, and a large manganiferous quartzite bed are discussed. This mineral wealth lies not in commercial deposits, but in its educational value to students of mineralogy for a new appreciation of beauty.—GDC

06335 **Carpenter, F. M.** The affinities of the genus *Sobobapteron* Pierce: Southern California Acad. Sci. Bull., v. 67, no. 4, p. 263–265, illus., 1968.

An insect wing described as *Sobobapteron kirkbyae* (Pierce, 1965), assigned to the extinct order Protorthoptera, was collected near San Jacinto, Calif., in shale previously determined as Pleistocene. Pierce was led to believe the shale was nearer Permian in age. A 'fringe of clubbed hairs', upon which he based his determination, actually is mineral deposition, as are darkened areas within the wing cells. Venation of the wing turns out to be that of a damsel fly of the living genus *Enallagma*, but its variability in details prevents establishment of precise synonymy. The specific name is considered valid, but the generic name *Sobobapteron* is herein placed as a junior synonym of *Enallagma*, and the species moved from Protorthoptera to Odonata. There is no question of the Pleistocene age of the Bautista Formation which produced the insect wing.—GDC

Carpenter, G. F. *See* Kupfer, D. H. 06111

00117 **Carroll, Robert L.** A Middle Pennsylvanian captorhinomorph, and the interrelationships of primitive reptiles: Jour. Paleontology, v. 43, no. 1, p. 151-170, illus., 1969.

Paleothyris acadiana n.gen.,n.sp. is described from the Middle Pennsylvanian Morien Group of Florence, Nova Scotia. Two nearly complete skeletons and numerous disarticulated specimens were found in a single upright lycopod stump. On the basis of this genus, the phylogeny of the family Romeriidae is considered and the relationship of this family to other primitive reptiles is discussed. It is concluded that *Araeoscelis* should be classified among the captorhinomorphs, rather than as an euryapsid, that diadectids can be considered aberrant offshoots of the same stock which gave rise to typical primitive reptiles, that mesosaurs arose from early captorhinomorphs, and that pelycosaurs and romeriids share a common ancestry above the level of the limnoscelids.—*from* Author's abstract

00076 **Carson, Bobb; McManus, Dean A.** Seismic reflection profiles across Juan de Fuca canyon: Jour. Geophys. Research, v. 74, no. 4, p. 1052-1060, illus., 1969.

Continuous seismic profiles along a 350-km track over Juan de Fuca canyon reveal the canyon to consist of two distinct parts. The narrow upper canyon is carved in consolidated or semiconsolidated material. The lower canyon consists of channel deposits with disturbed discontinuous reflectors, channel-border deposits with indications of mass movement, and parallel-bedding deposits extending to or covering mudstone basement ridges. Development of the lower canyon and deposition of the parallel-bedding unit apparently occurred simultaneously, so that the lower canyon actually represents a small fan and valley feature that filled basins in the continental borderland-type lower continental slope. Subsequently, Nitinat fan was constructed on the deep-sea floor at the present terminus of Juan de Fuca canyon.—*from* Authors' abstract

Carter, M. Devereux. *See* Wood, Gordon H., Jr. 00066

06121 **Cartwright, Keros.** Temperature prospecting for shallow glacial and alluvial aquifers in Illinois: Illinois Geol. Survey Circ. 433, 41 p., illus., tables, 1968.

Theoretically, if shallow aquifers are nonuniformly distributed laterally, and if heat effects can be measured and distinguished from other factors that affect soil temperature, a possible method for detecting shallow aquifers is indicated. A positive (warm) anomaly is expected over the aquifer in winter and negative in summer; its size depends on thermal properties of overburden, temperature difference between surface and aquifer, and burial depth of aquifer. Soil temperature measurements in central Illinois, by electric thermometer at depth of 18 in. in seven areas of till show maximum anomalies of about 2°C over a known shallow aquifer generally greater in summer than in winter. Effects of summer vegetation can be as great as the aquifer anomaly; in the more permeable soils it can be reduced by rain. Frozen soils tend to eliminate anomalies. In general, aquifer location agrees closely with thermal anomaly.—GDC

Carver, Robert E. *See* Cheetham, Alan H. 00108

06014 **Case, J. E.** Upper Cretaceous and lower Tertiary rocks, Berkeley and San Leandro Hills, California: U.S. Geol. Survey Bull. 1251-J, p. J1-J29, illus., geol. map, 1968.

In the Berkeley and San Leandro Hills east of San Francisco Bay, faulted and folded Upper Cretaceous marine beds attain an aggregate of 6,000-8,000 feet. Five stratigraphic units are recognized within Lawson's "Chico formation": (1) sandstone, shale, and conglomerate, here named Joaquin Miller Formation, at bottom; (2) Oakland Conglomerate; (3) shale and sandstone, here named Shephard Creek Formation; (4) sandstone, shale, and conglomerate, here named Redwood Canyon Formation, and (5) variegated shale. The Upper Cretaceous strata are interpreted to lie west of the axis of maximum depositional thickness in the Late Cretaceous miogeosyncline. Recognition of overlying Paleocene (newly named Pinehurst Shale) and Eocene strata indicates that the early Tertiary marine basin

extended about 10 miles farther southwest than previously suspected.—*from* Author's abstract

Cassie, Robert M. *See* Gates, Robert M. 05999

00127 **Chamberlain, C. Kent.** Carboniferous trilobites—Utah species and evolution in North America: Jour. Paleontology, v. 43, no. 1, p. 41–68, illus., 1969.

Mississippian and Pennsylvanian sections in Utah have produced these species, roughly from oldest to youngest: *Proetus (Pudoproteus) missouriensis, Phillipsia tuberculata, Thigriffides? ameuroides, Richterella loganensis, Paladin chesterensis, P. retrolatus n.sp., P. mucronatus, P. morrowensis, P. pyriformus, n.sp., Sevillia sevillensis, S. trinucleata, S. nucleata n.sp., Ditomopyge parvula, Ameura missouriensis, A. major. Sevillia* is emended to include some forms without anterior borders. Lower Mississippian sections in North America have great diversity of trilobite taxa. *Paladin*, almost the only survivor into Upper Mississippian, is the probable source of the Pennsylvanian *Sevillia and Ameura. Ditomopyge* is probably of the *Griffithides* lineage.—VMJ

06174 **Charyula, V.; Horn, M. K.** Geochemical and logging applications of a computer simulated neutron activation system, *in* Computer applications in the earth sciences—Colloquium on simulation: Kansas Geol. Survey Computer Contr. 22, p. 35–42, illus., tables, 1968.

A computer program is presented for simulating gamma-ray energy spectra of neutron activated elements. Input parameters of the program are: mass of the sample, abundance, half life, gamma energies and activation cross section of the element, duration of irradiation, and time of detection. The output is the individual spectra of each isotope in the sample and the composite spectrum of the sample. By means of this program, it is possible to simulate neutron activation experiments for different rock samples under varying conditions of irradiation and detection times.—Authors' abstract

Chase, A. E. *See* Dorin, A. H. 05954

05930 **Chayes, Felix.** On locating field boundaries in simple phase diagrams by means of discriminant functions: Am. Mineralogist, v. 53, nos. 3–4, p. 359–371, illus., tables, 1968.

The traces of discriminant functions computed from the data are in excellent agreement with field boundaries shown in a number of published phase diagrams. The substitution of a systematic numerical procedure for the conventional inspection technique by which field boundaries are located might reduce the amount of time and effort now sometimes devoted to obtaining points very close to the supposed trace of the field boundary. The principal advantage of the numerical procedure, however, is that it may be applied in multicomponent space, in which the location of field boundaries by graphical inspection is impossible.—Author's abstract

00108 **Cheetham, Alan H.; Rucker, James B.; Carver, Robert E.** Wall structure and mineralogy of the cheilostome bryozoan *Metrarabdotos*: Jour. Paleontology, v. 43, no. 1, p. 129–135, illus., tables, 1969.

The box-shaped zooecia of the two living and of five Tertiary species consist of: (1) a smooth primary skeleton including the basal, lateral, and distal walls, and the inner layer of the frontal wall; (2) a finely to coarsely tuberculate superficial layer of the frontal wall. In thin section the primary skeleton is longitudinally lamellar, and the superficial tissue is either wavy-lamellar or fibrous. Bulk X-ray diffraction analysis and differential staining with Feigl's solution suggest that lamellar tissue of both types is calcitic, whereas fibrous material is aragonitic. The living species that has a lamellar superficial layer is wholly calcitic; the living species that has a fibrous superficial layer becomes progressively more aragonitic during zooecial ontogeny.—*from* Authors' abstract

Chen, Albert T-F. *See* Schiffman, Robert L. 00157

06011 **Christensen, Nikolas I.** Chemical changes associated with upper mantle structure: Tectonophysics, v. 6, no. 4, p. 331–342, illus., tables, 1968.

Petrologic models to explain the low velocity zone in the upper mantle rely, in addition to high thermal gradients, on chemical changes or variations in physical state which require a density minimum in the upper mantle. It is suggested that this zone coincides with a region of increasing iron content. Ultrabasic inclusions with olivine close to 10 percent fayalite are representative of mantle composition at the M–discontinuity. Theoretical investigations of density–velocity relations and shock–wave data for dunites indicate that the intermediate region of the mantle contains rock with total iron content equivalent to olivine with 20–40 percent fayalite. An upper mantle model is proposed in which iron–magnesium ratio increases with depth; a change in fayalite content of olivine from 10 to 25 percent would decrease seismic velocities 0.25–0.35 kmps and increase density 0.20 g per cm^3.—*from* Author's abstract

00283 **Christiansen, E. A.** The physical environment of Saskatoon, Saskatchewan, Canada [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 7, 1969.

06187 **Clancy, Edward P.** Tides in the Earth, Chap. 9 *in* The tides—Pulse of the Earth: Garden City, N.Y., Doubleday and Co., p. 158–184, illus., 1968.

The nature of the interior of the Earth is reviewed to evaluate its response to tidal forces and calculate the moment of inertia. Seismic waves from earthquakes provide extensive information on the internal structure. The nature of earth tides and partial tidal forces and possible physical consequences are discussed. Troubles due to indirect effects, how to measure tilt, effects of vertical components of tidal force, and direct measurement of crustal distortion and compression are included.—ESL

05977 **Clark, Joan R.** Memorial of Arthur Lindo Patterson (July 23, 1902–Nov. 6, 1966): Am. Mineralogist, v. 53, nos. 3–4, p. 576–586, portrait, 1968.

Clayton, R. N. *See* Rex, R. W. 00140

Cleaves, Emery T. *See* Weaver, Kenneth N. 00182

00209 **Cleaves, Emery T.; Godfry, Andrew E.; Bricker, Owen P.** Water quality of a small unpolluted stream draining the Wissahickon Formation near Baltimore, Maryland [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 8, 1969.

00062 **Clee, T. E.; Savage, J. C.; Neave, K. G.** Internal friction in ice near its melting point: Jour. Geophys. Research, v. 74, no. 4, p. 973–980, illus., 1969.

The internal friction of ice near its melting point has been measured in the Athabasca glacier for Rayleigh waves from 0.025 to 0.18 kHz, for P waves from 0.12 to 1.0 kHz, and for S waves from 0.12 to 0.68 kHz. The mean Q for Rayleigh waves was 28, for S waves 23, and for P waves 65. From the attenuation data, it is shown that the internal friction in pure dilatation is much less than in pure shear. On this basis the Rayleigh and S–wave data may be reduced to equivalent P–wave attenuation coefficients, yielding an attenuation spectrum that extends from 0.025 to 1.0 kHz. Additional measurements by Westphal extend the spectrum to 5.0 kHz. These measurements supplement the work of Kuroiwa and permit one to conclude that the attenuation mechanism is most probably grain–boundary slip.—Authors' abstract

06303 **Clendening, John A.** *Gillespieisporites* gen. nov. and *Laevigatosporites plicatus* sp. nov. from Dunkard strata of the Appalachian basin: West Virginia Acad. Sci. Proc. 1968, v. 40, p. 262–269, illus., 1968.

Gillespieisporites venustus gen. et sp. nov. and *Laevigatosporites plicatus* sp. nov. are described from the Washington Formation, Dunkard group, Pennsylvanian system of West Virginia and Pennsylvania.—Author's abstract

Cobban, W. A. *See* Tourtelot, Harry A. 05864

Cocke, Nan Carnahan. *See* Merriam, Daniel F. 06110

06107 **Coene, G. T.** Future engineering possibilities, *in* Mineral resources of the world ocean—Symposium, Newport, R. I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, p. 75–79, 1968.

Ocean mining can be categorized into three basic environments: in-solution mining (extraction of elements from sea water); on-bottom mining (dredging for gravel, nodules, bottom placers); sub-bottom mining (recovery of petroleum, sulfur, etc., from wells or shafts). In-solution mining is chemical processing rather than true mining, and extraction plants are most economically located on shore. Current technology and economics and future possibilities are reviewed for recovery of mineral resources by on-bottom and sub-bottom mining, with emphasis on petroleum. The difference between the water depth at which oil wells can be drilled (1200 feet today, and increasing) and the depth at which they can be produced with fixed platforms (340 feet) represents a technology gap which must be filled.—VMJ

00274 **Cohen, Philip.** Response of the hydrologic system of Long Island, N. Y. to intensive urban and suburban development [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 8–9, 1969.

Coleman, James M. *See* Ho, Clara. 00114

05976 **Coleman, Robert G.** Memorial of Adolph Knopf (Dec. 2, 1882–Nov. 23, 1966): Am. Mineralogist, v. 53, nos. 3–4, p. 567–576, portrait, 1968.

00069 **Comer, G. H.; Zimmermann, R. C.** Low-flow and basin characteristics of two streams in northern Vermont: Jour. Hydrology, v. 7, no. 1, p. 98–108, illus., tables, 1969.

During a 6-year period, minimum flows in a 3.2 sq-mi subbasin of the Sleepers River in Caledonia County were 0.00027 in/h compared with 0.00003 in/h in an adjacent 8.4 sq-mi subbasin. As the climate, geology, and land use in the two basins are similar, the differences in flow are probably caused by differences in topography and in soils. Over half of the larger, Morrill Brook basin, but only 28 percent of the smaller, Pope Brook basin, have slopes of 8 percent or less. Poorly and very poorly drained fragipan soils occupy 44 percent of the larger basin cf. 22 percent of the smaller, steeper basin, where soils are deeper, with greater storage capacity, and surficially well-drained. Bedrock in both basins is primarily interbedded schist and limestone of the Waits River formation with a quartzitic ridge of the Gile Mountain formation in the western part. Surficial till deposits are mostly less than 15 feet thick.—GDC

00275 **Connally, G. Gordon; Sirkin, Leslie A.** Deglacial events in the Hudson Champlain Valley and their possible equivalents in New England [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 9, 1969.

05953 **Connolly, E. T.** Standardization of large volumes of log data for computer analysis, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. [L]1–[L]19, illus., tables, 1968.

Standardization of large volumes of log data requires the following major steps: (1) Normalize all curves to standard scales, to eliminate severe calibration errors. (2) Depth-correlate all curves within each well on 100-ft intervals. (3) Digitize on 6 inch or 1 ft increments and plot back. (4) Recalculate all data to standards for entry into a lithology-porosity saturation study. This paper describes how the above approach was applied to log data in the Rainbow-Zama area of Alberta, Canada. The examples include standard logs and many logs with serious calibrations, electrical, drafting, or simple human errors.—*from* Author's abstract

06040 **Cook, John T.** The geology of the Oxford area, Granville and Vance Counties, North Carolina [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4, p. 437–438, 1968.

06004 **Cooley, Tillman; Kline, Charles.** Gravity anomalies and suggested Brevard zone models [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4, p. 438–439, 1968.

Corry, C. E. *See* Sclater, J. G. 00073

00276 **Cottrell, John; Swinchatt, Jonathan P.** Facies variations in a black limestone, Cherry Valley Limestone, Devonian, N. Y. State [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 9–10, 1969.

Counts, H. B. *See* Georgia Geological Society. 06074

00141 **Cox, Allan.** Geomagnetic reversals: Science, v. 163, no. 3864, p. 237–245, illus., tables, 1969.

Changes in the Earth's dipole moment, polarity reversals, distribution function for polarity intervals, radiometric time scale for reversals,midocean magnetic anomalies, and sedimentary record of short events are discussed. On the average, 20 fluctuations in intensity occur between successive polarity reversals. The probability that a geomagnetic polarity reversal will result from the current decrease in dipole moment is 5 percent. The average length of polarity intervals has changed during the Earth's history, reflecting changes in the physical conditions which control the Earth's dynamo. The timing of polarity reversals may be controlled on two levels—the average length by conditions at the core–mantle interface and hence related to tectonic processes in the mantle, and the length of individual polarity intervals by random processes in the fluid core.—DBV

05895 **Cox, Allan; Doell, R. R.; Dalrymple, G. B.** Time scale for geomagnetic reversals, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies,1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 101–108, illus., tables, 1968.

Polarity epochs defined on the basis of measurement of polarities and K–Ar ages of volcanic rocks from continental and oceanic island areas range from 0.7 to 1.75 m.y. The various epochs date back as far as 10 m.y. B.P. Episodes termed events, representing briefer polarity fluctuations within a given normal or reversed epoch, are attributed to rapid changes of the main geomagnetic dipole. Correlation of different sets of time-dependent statistical properties of the intervals between successive polarity changes exhibit a homogeneity which permits the conclusion that the field was reversed for a total length of time equal to the total length of time during which it was normal. Tables calibrating data from K–Ar age measurements, deep-sea cores, and magnetic anomalies summarize the sequence of epochs and events.—MS

06021 **Cox, John W.** Interpretation of dipmeter data in the Devonian carbonates and evaporites of the Rainbow and Zama areas: Jour. Canadian Petroleum Technology, v. 7, no. 4, p. 164–171, illus., tables, 1968.

Structural dip trends available through the use of the continuous dipmeter log accurately define the source of structural anomalies in the Rainbow and Zama areas [Alberta]. The proper use of the tool in development drilling assists operators in penetrating more pay zone than would have been possible without this data. Better immediate evaluation of wildcat ventures is possible through application of dipmeter data early in the drilling operation.—Author's conclusions.

Craighead, Frank C., Sr. *See* Scholl, David W. 00142

Croneis, Carey. *See* Park, David E., Jr. 00148

06165 **Cronquist, Arthur.** The evolution and classification of flowering plants: Boston and New York, Houghton Mifflin Co. (Riverside Studies in Biology), 396 p., illus., 1968.

The five chapters in this book are: taxonomic principles; origin of the angiosperms; evolution of characters; the subclasses, orders, and families of dicotyledons; and of monocotyledons. A list of the classes, subclasses, orders, and families of

magnoliophyta and a glossary are appended. The last two chapters and the list deal mostly with living forms.—ESL

Crooks, Thomas J. *See* Gries, John Paul. 05880

06321 **Crosby, Percy.** Tectonic, plutonic, and metamorphic history of the central Kootenay arc, British Columbia, Canada: Geol. Soc. America Spec. Paper 99, 94 p., illus., tables, geol. maps, 1968.

In the Kootenay Lake area the Proterozoic to Triassic metasedimentary–metavolcanic section is over 20,000 feet thick. Cambrian clastics are conformable with the Precambrian section; the overlying Lardeau Group, highly metamorphosed in contrast to below-garnet grade elsewhere, is regionally unconformable to the Carboniferous–Triassic Milford Group. The mesozonal Nelson and Bayonne batholiths are partially concordant. Structure, fabric, and mineralogy suggest regional metamorphism preceding contact metamorphism, with mineral recrystallization synchronous with three phases of folding, and early reverse strike faults changed to normal later. Isotopic ages and Shuswap-type terrane imply interdependent multiple deformation, igneous intrusion, and prograde metamorphism extended over 100 million years, followed by a long period of adjustments to falling temperature and release of pressures.—GDC

00277 **Crowley, William P.** Stratigraphic evidence for a volcanic origin of part of the Bel Air belt of Baltimore gabbro complex in Baltimore County, Maryland [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 10, 1969.

05963 **Culver, James R.; Gray, Fenton.** Morphology and genesis of some grayish claypan soils in Oklahoma—[Pt.] 1, Morphology, chemical and physical measurements; [Pt.] 2, Mineralogy and genesis: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 845–857, illus., 1968.

Waurika soils and the proposed Nardin soils having grayish silty A Horizons over clayey B2t horizons occur intermittently on level landscapes among extensive brownish to reddish soils in the Reddish Prairies. The soils have thin silty A2 horizons with abrupt thick B2t horizons ranging from 42 to 55 percent clay. Clay, fine silt, organic matter, and carbonates were lost from the A horizons and were accumulated in the B2t horizons. A secondary maximum of organic matter accumulation occurs in the B2t horizons.—Editor's brief

Cunningham, R. L. *See* Petersen, G. W. 05934

Dahill, M. P. *See* Rackley, R. I. 05918

Dahl, H. Douglas. *See* Pariseau, William G. 06350

Dale, Barrie. *See* Wall, David. 06029

00210 **Dallmeyer, R. David.** Multiple deformation of Precambrian gneisses at Bear Mountain, New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 10–11, 1969.

Dalrymple, G. B. *See* Cox, Allan. 05895

00059 **Dansgaard, W.; Johnsen, S. J.** Comment on paper by J. Weertman, "Comparison between measured and theoretical temperature profiles of the Camp Century, Greenland, borehole" [1968]: Jour. Geophys. Research, v. 74, no. 4, p. 1109–1110, illus., 1969.

Weertman (ibid., v. 73, no. 8, p. 2691–2700, 1968) reported a difference of several degrees between the measured temperature profile of the Camp Century borehole and a profile calculated from the Robin (1955) theory with the addition of correction terms for the generation of heat by friction and for horizontal flow. The assumption that the velocity component Vy is approximated by Vy/h (h = ice sheet thickness) seems to be the reason for the discrepancy. A corrected theoretical curve would agree with the measurements along the entire core within ±0.6°C and would deviate

only 0.3°C at the bottom. It is concluded that the temperature profile depends strongly on mode of flow and that mean rate of accumulation over the past 10,000–15,000 years was considerably less than today's.—DBV

David, David. *See* Komornik, Amos. 00155

00261 **Davies, William E.** Urbanization and geologic hazards [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 11, 1969.

Davis, G. A. *See* Burchfiel, B. C. 06113

Davis, G. L. *See* Krogh, T. E. 00241

00262 **Davis, James F.** Recent trends in higher education in geology in the northeastern United States [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 11–12, 1969.

00263 **Davis, James F.** A subsurface investigation of the bedrock configuration of the Hudson River Valley and its tributaries between Albany and Catskill, New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 12, 1969.

05947 **Dawson-Grove, G. E.; Palmer, K. R.** A practical approach to analysis of logs by computer, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. E1–E11, tables, 1968.

A brief description and examples are given of the Home Oil porosity/lithology computer programs. They involve simultaneous analysis of the sonic, density and neutron logs, and testing for eight components, including porosity if desired; and depend on solution of four equations, 70 times for each foot of well depth. This results in 70 possible answers for every foot, but various constraints, including using the gamma-ray log as a monitor and(or) a sequential frequency analysis, are used to select the correct answer. There are three separate programs, the carbonate, sand-shale, and potash programs. The computer-derived lithology logs agree very closely with drill cutting sample records and other available control.—*from* Authors' summary

Dayley, Jon. *See* Swanson, Earl H., Jr. 06169

05973 **Dearborn, Grace G.** Hugh Alexander Ford (July 26, 1885–March 11, 1966): Am. Mineralogist, v. 53, nos. 3–4, p. 548–551, portrait, 1968.

05927 **deBoer, Jelle.** Late Triassic volcanism in the Connecticut Valley and related structure, Trip C–5 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 12 p., paged separately, illus., 1968.

Six stops on a field trip are made, each examining a different aspect of the volcanic history of the area. Three lava-flow units can be distinguished, which are, from oldest to youngest: Talcott, Holyoke, and Hampden. The complexity and thickness of the units increase toward the south. Chemical analyses show slight differences in the distribution of the major oxides. Intrusive masses occur along the western border of the valley in its southern part, and the New Haven Arkose is generally the host rock. So far, it has not been possible to correlate the lava flows with the intrusives by petrology, although paleomagnetism can be used to differentiate the volcanics; four events, one Jurassic, are recognized. There is an unconformity between the Triassic rocks and the Jurassic intrusives.—HRC

06345 **Delfino, Joseph J.; Lee, G. Fred.** Chemistry of manganese in Lake Mendota, Wisconsin: Environmental Sci. and Technology, v. 2, no. 12, p. 1094–1100, illus., tables, 1968.

A proposed manganese system accounts for the presence of manganese in different forms in stratified lakes such as Lake Mendota, a hard-water, eutrophic lake of glacial origin. In field and laboratory studies, only Mn(II) was detected in anoxic

waters, whereas both Mn(II) and manganese oxides are present in oxygenated waters. Throughout the year, manganese exists primarily in the Mn(II) form, and the small amounts of manganese oxides are not detected in the anoxic summer hypolimnion.—Editor's abstract

06324 **Dengo, Gabriel.** Estructura geológica, historia tectónica y morfología de America Central: México, D.F., Centro Regional de Ayuda Técnica, 50 p., illus., 1968.

In this study, a synthesis of ideas presented in several previous papers (Dengo, 1962–67), Central America is defined as the area extending from the Isthmus of Tehuantepec in Mexico, south to the lowlands of Atrato in northwestern Colombia. Tectonic history is reconstructed for the three main geologic divisions: northern Central America, underlain by Paleozoic crystal'ine rocks of continental crustal type; southern Central America, underlain by Mesozoic basic rocks of oceanic crustal type; Pacific marginal zone, comprising the Middle American trench and related Quaternary volcanic chain. Structural and paleogeographic relations with the Caribbean region are discussed. Eight morphotectonic units are established, each presenting a characteristic relief expressing the underlying geologic structure.—VMJ

Denison, R. E. *See* Burke, W. H. 00075

00052 **Denison, Rodger E.; Kenny, George S.; Burke, William H., Jr.; Hetherington, Ernest A., Jr.** Isotopic ages of igneous and metamorphic boulders from the Haymond Formation (Pennsylvanian), Marathon basin, Texas, and their significance: Geol. Soc. America Bull., v. 80, no. 2, p. 245–256, illus., tables, 1969.

Petrographic and chemical characteristics supported by high Sr–87:Sr–86 ratio of 0.713 suggest that granitic and metarhyolitic boulders in the Haymond Formation were derived by partial melting of sediments. Rb–Sr and K–Ar give ages from 370 to 410 m.y. suggesting maximum subsidence of a geosyncline to the southeast of the Marathon Basin in Silurian–Devonian time. Resulting volcanism offers a source for silica in the Caballos Novaculite. The mountain building that followed (called the Llanorian Orogeny) supplied the source for the flysch sequence in the Marathon Basin.—AH

Dennis, C. L. *See* Hilchie, D. W. 05951

00089 **Dennis, Robert L.** Fossil mycelium with clamp connections from the Middle Pennsylvanian: Science, v. 163, no. 3868, p. 670–671, illus., 1969.

A mycelium with clamp connections and chlamydospores has been discovered within the wood of a Middle Pennsylvanian fern. This suggests that forms extant in the middle of the Pennsylvanian had life cycles comparable to some modern Basidiomycetes.—Author's abstract

00264 **Dennison, John M.** Tioga Bentonite and other isochronous units in the Devonian Oriskany to Tully interval of the Appalachian basin [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 13, 1969.

06180 **Desautels, Paul E.** The mineral kingdom: New York, Madison Square Press, 252 p., illus., 1968.

This is not a highly methodical overview of the mineral kingdom, but rather an introduction to a broad field of knowledge for developing interests of the amateur. However, it is written from the point of view of the mineralogist who sees the mineral kingdom as a changing, developing edifice based on solid substances. Chapter headings are: myth, fancy, and fact; flowers of the kingdom; gemstones—the royal line; wonders of the kingdom; in search of treasures—classic sites; mineral masterpieces; the science and its framework; minerals at work; the hobby; and the connoisseur. The book is profusely illustrated with color photographi and has a comprehensive index.—MCM

05890 **Dewey, John; Kay, Marshall.** Appalachian and Caledonian evidence for drift in the North Atlantic, *in* The history of the Earth's crust, a symposium (Robert

A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 161–167, illus., 1968.

Counterparts of the three pre-Carboniferous belts of contrasting structure and stratigraphic sequences of the Maritime Appalachians of Newfoundland are identified in the British Caledonides. Similarities are sufficiently close to warrant the assumption that the belts were formerly contiguous.—MS

00102 **Dietrich, R. V.; Fullagar, P. D.; Bottino, M. L.** K/Ar and Rb/Sr dating of tectonic events in the Appalachians of southwestern Virginia: Geol. Soc. America Bull., v. 80, no. 2, p. 307–313, illus., tables, 1969.

Six K–Ar and 14 Rb–Sr analyses were made on samples from the Blue Ridge crystalline "Complex" and the adjacent Valley and Ridge sedimentary bedrock. Included are "Older Precambrian" gneiss(es); Cambrian shale–siltstone; and sheared, mylonitized, and brecciated equivalents of these rocks. The oldest isotopic ages found are 687 ± 15 m.y. and 1320 ± 100 m.y. for the Grayson and Little River gneiss units; the youngest are 345 ± 16 m.y. and 330 ± 15 m.y. on samples from two fault zones. Tentative conclusions are: (1) Some activity, probably the development of frictional heat that accompanies faulting, may cause adjustments of isotopic ratios so that the resulting "ages" indicate time of the faulting; and (2) isotopic data on rocks from such fault zones may also give clues as to the depth of faulting.—*from* Authors' abstract

06310 **Dietz, Robert.** Shatter cones and star wounds: New Scientist, v. 40, no. 625, p. 501–503, illus., 1968.

Shatter cones, distinctive fracture structures produced in rocks by intense shock forces, seem inadequately accounted for by volcanic explosions; they must be related to astroblemes, or an unknown geologic mechanism deep within the Earth. To be sure we are dealing with impact structures, remnants of the cosmic missile must be found. Of many other natural coned and striated or fluted rocks, cone-in-cone structures, the most often misidentified, occur in thin shales and are marked with horizontal rings rather than vertical striations. Of 19 known shatter-coned scars of the world, most are in North America and are moderate in size. The Sudbury structure, Ontario, is one of two of Precambrian age a few tens of miles in diameter. The validity of the shatter-cone criterion is strengthened by their recognition in the 1967 discovery of Malbaie astrobleme, a deeply eroded 37-km scar of early Paleozoic age, near Quebec.—GDC

00104 **Dill, Robert F.** Earthquake effects on fill of Scripps Submarine Canyon: Geol. Soc. America Bull., v. 80, no. 2, p. 321–327, illus., table, 1969.

Observations by scuba diving in the heads of Scripps and La Jolla Submarine Canyons have shown that three strong earthquakes (5, 5.8, and 6.3 on the Richter scale) did not trigger failure in marginally stable marine sediments. *In situ* density measurements compared with laboratory tests of canyon sediments show that fill accumulating under nearshore environmental conditions is near its critical density and will neither expand nor contract when stressed. Sands with these properties cannot be considered to be metastable or expected to fail by spontaneous liquefaction. Movements of sandy sediment from the canyon head into deep water have not been by earthquake-triggered turbidity currents but by other observable mass-movement processes.—Author's abstract

00265 **Dimroth, Erich.** The evolution of the Labrador geosyncline [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 13–14, 1969.

00090 **DiSalvo, Louis H.** On the existence of a coral reef regenerative sediment: Pacific Sci., v. 23, no. 1, p. 129, 1969.

A mudlike detrital sediment, generally present in dead coral spaces, has an organic content of 12 percent and upward, and contains large numbers of bacteria capable of active metabolism. The bacteria could invade at least one species of massive coral skeleton. These discoveries may provide new insights and interpretations of reef geology.—ESL

Dixon, H. R. *See* Goldsmith, Richard. 06047

06044 **Dixon, H. Roberta; Eaton, G. P.; Lundgren, L. W., Jr.** A structural and stratigraphic cross-section traverse across eastern Connecticut, Trip F-4 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 23 p., paged separately, illus., 1968.

A field trip of 137.5 miles makes 13 stops with a view to showing some of the evidence by which the overturned syncline, projected across much of eastern Connecticut,has been recognized and to show correlative units within different parts of the structure. The structure is not a nappe but a folded syncline, and the formations of each limb can be correlated. On the normal limb, the section is, from bottom to top: Quinebaug Formation, Tatnic Hill Formation, Hebron Formation, and Scotland Schist. On the overturned limb, the following are recognized, from bottom to top, and correlative with the others save for the Scotland: Middletown-Monson Gneisses,Brimfield Schist, and Hebron Formation. The rocks are Devonian and older.—HRC

06064 **Dobrovolny,Ernest; Schmoll, Henry R.** Geology as applied to urban planning—An example from the Greater Anchorage Area Borough, Alaska, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 12, Engineering geology in country planning: Prague, Academia, p. 39-56, illus., table, 1968.

A geologic report on the Anchorage lowland, published in 1959 by the USGS reached few individuals directly responsible for local planning. The report contains information useful in development planning and specifically identifies the Bootlegger Cove Clay, which underlies much of Anchorage, as an unstable material when wet, that can be dislodged along steep slopes by some triggering action. In consequence of the geologic effects of the Alaska earthquake and its impact on land development, local government officials requested the USGS for additional geologic work deemed necessary for Borough-wide planning. A general geologic map is being prepared, also special purpose interpretive maps to provide data on mineral and construction resources, terrain, ground stability, surface water, and ground water.—*from* Authors' ar stract

Doell, R. R. *See* Cox, Allan. 05895

06325 **Doelling, Hellmut H.** Carcass Canyon coal area, Kaiparowits Plateau, Garfield and Kane Counties, Utah: Utah Geol. and Mineralog. Survey Spec. Studies 25, 23 p., illus., table, 1968.

The coal-bearing Straight Cliffs Formation of Cretaceous age is the dominant assemblage exposed in the Carcass Canyon area. The walls of the canyon, deeply incised in the Kaiparowits Plateau,are studded with coal outcrops. Wherever found, two of the zones consistently contain coal seams of minable thickness (3 feet or better). Seams were mapped in reconnaissance fashion and 100 coal sections were measured. A composite section of the entire Straight Cliffs Formation and 14 analyses of coal samples are included in this report. Assuming a 50 percent recovery, it is estimated that nearly 260,000,000 short tons of high volatile C bituminous coal is recoverable from the area.—Author's abstract

06129 **Doelling, Hellmut H. S.** Utah oddities lure rock hounds: Utah Geol. and Mineralog. Survey Quart. Rev., v. 2, no. 3, p. 7, illus., 1968.

Countless ironstone and limonite concretions, usually associated with sandstones, are found in southern Utah; each nodule is a thick bubble (limonitic portion) with sand in the center. A scum of iron gel apparently formed at the top of the water table within the unconsolidated Navajo sand; when the sand was compacted, air and water were forced out and frothed the gel. Iron concretions of the Straight Cliffs Formation may have had a different origin than those of the Navajo; some are the product of pyrite oxidation. Nodules of fine-grained pyrite are abundant. When coal beds in the Kaiparowits Plateau burned, overlying rock collapsed, brecciated, and was later cemented by melted rocks, forming varicolored stones.

Other collector's items in the area are septarian concretions, vugs with dogtooth spar, and siliceous nodules.—ESL

05961 **Dolcater, D. L.; Lotse, E. G.; Syers, J. K.; Jackson, M. L.** Cation exchange selectivity of some clay-sized minerals and soil materials: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 795-798, illus., tables, 1968.

Cation exchange selectivity values for montmorillonite, vermiculite, biotite and muscovite, and micaceous vermiculitic clays from Triangle and Harpster soils, Idaho and Iowa, were determined by equilibrating each with a mixed solution of two competing cations. Cation affinity of Na-saturated materials increased in different order for each clay mineral. Micaceous vermiculite, Na-saturated, gave a K/Ca CES value of 0.2 compared to 0.4 for K-saturated, dried vermiculite, indicating that many interlayer wedges created by structural collapse in the latter increased the K selectivity. K-saturated and dried muscovite's value of 4.0, compared to 0.4 for similarly treated vermiculite with equal exchange capacity, suggests the large influence of layer charge density upon K selectivity. Higher CES values for muscovite than for biotite are explained by smaller ditrigonal holes and oblique orientation of hydroxyl groups in muscovite structure.—GDC

05954 **Dorin, A. H.; Chase, A. E.** A guide to improved formation evaluation in carbonates of northwestern Alberta, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. [M]1-[M]19, illus., tables, 1968.

The Porosity-Lithology Log and Sonic Logs can usually resolve the complex lithology, porosity, and pore-structure problems prevalent in most Middle Devonian formations of northwestern Alberta. Knowledge of these parameters permits more accurate calculation of water saturation and hydrocarbon reserves. Fluid production potential cannot be determined from a knowledge of porosity and water saturation alone. When cross-plotted they are a valuable aid to establishing zones that will produce hydrocarbon without water from various known pore geometries. The logs provide the data to make these determinations; their application may very well provide the key to solving some difficult production problems.—*from* Authors' conclusions

00266 **Douglass, P. M.; Voight, Barry.** The effect of cracks on the intrinsic Young's moduli of rocks [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 14, table, 1969.

00144 **Drake, C. L.** Drilling and coring the deep-sea floor: Science, v. 163, no. 3867, p. 596-597, 1969.

Papers presented at a symposium on drilling and coring the deep-ocean floor at Columbia University, November 25, 1968, are discussed. Members of the scientific party on the first leg of the drilling program started by JOIDES discussed the results of drilling.—KAF

Drugg, Warren S. *See* Loeblich, Alfred R., Jr. 06347

06147 **Duguid, James Otto.** Reply by author to discussion by Lyle V. A. Sendlein [of "Refraction determination of water-table depth and alluvium thickness", 1968]: Geophysics, v. 33, no. 6, p. 1020-1021, 1968.

Sendlein [ibid., p. 1019-1020] suggests two errors in Duguid's paper [ibid., v. 33, no. 3, p.481-488, 1968]; these were errors in plotting of the data rather than errors in the data.—DBV

00267 **Dunn, James R.** Construction materials for megalopolis [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 15, 1969.

00268 **Eastler, Thomas E.** Sole marks in non-turbidite sequences [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 15-16, 1969.

Eaton, G. P. *See* Dixon, H. Roberta. 06044

06315 **Eckelmann, F. Donald.** Geology, Chap. 6 *in* The encounter between Christianity and science (Richard H. Bube, editor): Grand Rapids, Mich., William B. Eerdmans Publishing Co., p. 135–170, table, 1968.

Contributions of scientists since Copernicus have led to the fundamental geologic concepts of the great antiquity of the Earth, uniformitarianism, and organic evolution. Of all theological doctrines affected, only man (particularly his origin) is considered in this chapter. Theories of Darwin, supported by work of Malthus and Lyell, have proved to be the most controversial for Christians. The paleontological record of man and its general record are presented briefly, with implications for, and integrations with, Christian theology. Eckelmann considers his position (that organic evolution is a general method of creation) consistent with basic boundary conditions derived from data of both science and Christian theology.—MCM

06070 **Eden, W. J.; Poorooshasb, H. B.** Settlement observations at Kars Bridge [with French abs.]: Canadian Geotech. Jour., v. 5, no. 1, p. 28–45, illus., table, 1968; closure to discussion, ibid., no. 4, p. 248, 1968.

A 26-ft high approach fill was conducted in 1959 for a bridge over the Rideau River near Kars, Ontario. The fill was placed over 50 feet of Leda clay, the lower 30 feet of which were extremely sensitive and compressible. Settlement gauges and piezometers under the fill have been observed since the start of construction. After 7 1/2 years, 20 in. of settlement has occurred under the centre of the fill. Settlements are continuing at an appreciable rate although excess pore water pressure has dissipated to a low level and is nearly constant through the clay layer. Field observations of settlement and pore water pressure are compared with values calculated, and a closed form solution to the process of consolidation is obtained by a heat balance integral technique and by considering the clay layer to be a rigid plastic.—*from* Authors' abstract

Edwards B. *See* Hipp, Billy. 05957

Elliott, Raymond L. *See* Miller, Thomas P. 00168

Ellison, Samuel P., Jr. *See* Keller, Walter D. 05975

06338 **Emery, K. O.; Ross, David A.** Topography and sediments of a small area of the continental slope south of Martha's Vineyard: Deep-Sea Research, v. 15, no. 4, p. 415–422, illus., table, 1968.

A small area of the continental slope off the northeastern United States between depths of 950 and 1,750 m was studied from both a surface ship and a research submarine. The area borders the Alvin Submarine Canyon; it is smooth except for partial dissection by a tributary of the canyon and by some small gullies. Among the unexpected findings was a series of six long low ridges that extend directly downslope and across the observed bottom current; their origin is unknown. Most of the smaller topographic features are due to activities of animals. Currents of 70 cm/sec have been ineffective in shaping the bottom. [Composition of sediment samples from near Alvin Canyon is tabulated in relation to position and grain size.]—*from* Authors' abstract

Emiliani, C. *See* Rona, E. 00137

00269 **Emslie, Ronald F.** The timing and mode of intrusion of large anorthositic complexes in the eastern Canadian shield [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 16, 1969.

00270 **Epstein, Claude M.** Lithofacies and paleoenvironments of the Kalkberg Formation (Lower Devonian) of central New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 16–17, 1969.

06068 **Erwin, John W.** Gravity map of Tonopah, Baxter Spring, Lone Mountain and San Antonio Ranch quadrangles, Nevada: Nevada Bur. Mines Map 36, scale 1:125,000, text, 1968.

The present topography of the Tonopah area in Esmeralda and Nye Counties is the result of Tertiary and Quaternary faulting and erosion; rocks range in age from Precambrian to Quaternary. A density of 2.2 gm/cm^3 seems a reasonable estimate for the Tertiary–Quaternary sequence, and in general, Precambrian, Paleozoic, and Mesozoic sediments and intrusive rocks have an average density of 2.67 gm/cm^3. Prominent negative anomalies are: Big Smoky Valley, –20 mgals; Ralston Valley, –15 to –20 mgals; and Montezuma Valley–Lone Mountain, –15 to –20 mgals. Two local gravity highs are noted near the Divide district.—MCM

00126 **Ewing, J.; Leyden, R.; Ewing, M.** Refraction shooting with expendable sonobuoys: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 174–181, illus., table, 1969.

The use of expandable radio sonobuoys and a nonexplosive (air gun) sound source for shallow-water refraction studies has shown that the sonobuoys can produce excellent refraction and wide-angle reflection data, and that measurements can be made during normal reflection profiling operations utilizing the same source of acoustic energy. The data are recorded in a manner that permits immediate analysis, thus better enabling the investigator to guide and evaluate a survey while it is in progress.—Authors' abstract

Ewing, M. *See* Ewing, J. 00126

00271 **Fauth, John L.** Structural development of a portion of the Blue Ridge, south-central Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 17, 1969.

Fenner, Peter. *See* Stanley, Daniel K. 00202

06035 **Field, Michael E.** Detrital feldspar in beach, river, and shelf samples of the Atlantic southeast United States [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4, p. 439–440, 1968.

06081 **Finch, Warren I.** Engineering geology of the Calvert City quadrangle, Livingston and Marshall Counties, Kentucky: Kentucky Geol. Survey, ser. 10, Inf. Circ. 16, 28 p., illus., tables, 1968.

Surficial deposits are extensive silt and clay underlain in uplands by well-graded gravel, and in lowlands by variable finer sand resting on sandy gravel. Bedrock includes poorly consolidated Cretaceous sand and gravel, and hard Paleozoic limestone and chert in which solution cavities often cause foundation problems. Calvert City is about 80 miles from the New Madrid, Mo., earthquake epicenter. Engineering properties of the above materials vary; test data presented are referred to U.S.G.S. Geologic Quadrangle Map GQ–731 (not included). Ground water is available in large quantities, its shallowest levels 310–330 feet above sea level. Its circulation through underlying cavities into Devonian and Mississippian formations rules out their use for waste disposal; older St. Peter Sandstone and Knox Dolomite may be sufficiently porous for liquids. The Fort Payne Formation where overlain by 100 feet of Knox Dolomite, and free of joints, is suitable for gas storage.—GDC

00272 **Finks, R. M.; Jantzen, R. E.; Alexandrov, V. A.; Avignone, N. F.; Warshauer, S. M.** Coral growth rates as a paleoecologic tool in the study of Onondaga reefs [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 17–18, 1969.

06318 **Finlay, Walter L.** Silver-bearing copper—A compendium of the origin, characteristics, uses and future of copper containing 12 to 25 ounces per ton of silver: [New York] Corinthian Editions, 356 p., illus., tables, 1968.

Silver-bearing copper (used by primitive man at least 9,000 years ago) looks and acts like copper in most respects, but 12 to 25 ounces of silver per ton give it the

highest combination of conductivity and strength in its service temperature range of any material; it also has advantages over ordinary copper in oxidation and wear resistance. It is produced from the White Pine mine in the Upper Peninsula of Michigan, where proved reserves are adequate for at least a half century and constitute 15 percent of known copper reserves of North America. The geologic background of the mine is reviewed along with mining and smelting information, and uses of silver-bearing copper are examined in detail. Appendixes cover the story of early man and copper, the properties of silver-bearing copper, and its uses.—ESL

00093 **Fisher, David E.** Fission-track ages of deep-sea glasses: Nature, v. 221, no. 5180, p. 549–550, table, 1969.

Results are presented of fission-track determinations of the age of 11 deep-sea glasses, representing the glassy crust of basaltic rocks dredged from the crest of the East Pacific rise at about 10°S and from four seamounts at distances of 0 to 1,500 km from the rise. These ages set upper age limits to the time of outflow much less than the K-Ar ages. From these upper age limits and measured Ar-40 contents,approximate values for excess Ar-40 are established. The fission-track technique provides a quantitative criterion for estimating the extent of such excesses, making it possible to study mantle-ambient rare gas abundances and composition if current theories regarding upwelling of mantle material along the crests of active oceanic ridges are valid.—DBV

00259 **Fisher, Donald W.** Paleozoic geology of the Lake George-Glens Falls-Fort Ann, New York region [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 19, 1969.

00273 **Fisher, Donald W.; Reilly, Edgar M., Jr.** New discoveries of Late Pleistocene mammals in the Hudson Valley [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 18, 1969.

00132 **Fisher, W. L.; Rodda, Peter U.** Edwards Formation (Lower Cretaceous), Texas—Dolomitization in a carbonate platform system: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 55–72, illus., table, 1969.

In Texas the Edwards Formation of Lower Cretaceous age consists mainly of various types of carbonates and evaporites. Two types of secondary dolomite, designated as massive and stratal, are also present in the formation. The area of deposition consisted of a shallow-water, massive platform on which there were two lagoons; this platform was surrounded by deeper basins. The dolomites are the result of metasomatic replacement of calcium carbonates in belts marginal to the lagoonal areas. The magnesium enriched brines responsible for the dolomitization were part of the depositional system, and the process of dolomitization was controlled by depositional facies.—SEF

00147 **Fisher, W. L.; McGowen, J. H.** Depositional systems in Wilcox Group (Eocene) of Texas and their relation to occurrence of oil and gas: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 30–54, illus., 1969.

This paper is the same, with a few modifications, as the one published in Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 105–125, 1967 (*see* Abstracts of North American Geology, June 1968).—VSN

Flach, Klaus W. *See* Nettleton, Wiley D. 06077

05917 **Flanagan, Phillip E.** The nuclear industry in Wyoming—1968, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 109–113, illus., tables, 1968.

Most of the uranium exploration activity is in the Wind River basin, Shirley basin, and the southern part of the Powder River basin. The South Pass and Red Desert areas of the Green River basin have also been explored. A small-scale map shows the locations. Production figures are reviewed briefly.—HRC

Flint, Richard Foster. *See* Longwell, Chester R. 00084

05952 **Fons, Lloyd.** Acoustic logging through casing, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. J1–J10, illus., 1968.

Formation acoustic interval time measurements in cased wells can be directly (conventionally) recorded opposite most of the cemented interval. Where reliable conventional recordings cannot be made, acoustic scope pictures or magnetic recordings of full wave information can be used opposite zones exhibiting some degree of cement bonding to construct the interval time curves. The acoustic information obtained through casing is comparable in quality to that obtained in uncased walls.—Author's conclusions

06051 **Foose, Richard M.** Surface subsidence and collapse caused by ground water withdrawal in carbonate rock areas, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 12, Engineering geology in country planning: Prague, Academia, p. 155–166, illus., 1968.

Lowering of the ground-water surface in unconsolidated debris above carbonate bedrock has caused surface subsidence and collapse near mining operations in North America and Africa. Catastrophic sinkholes and large areas of subsidence result when the bedrock surface is deeper than the original water surface. The size of these surface features increases with greater thickness of debris and with greater water drawdown. Examples are described in Pennsylvania, and near Johannesburg, South Africa. Gravity measurements combined with drill-hole data and photogeologic mapping have proved useful in delineating areas of very thick overburden within which sinkholes might form. Seismic listening techniques offer promise for pinpointing developing subsurface cavities. Other techniques for discovery and warning are discussed.—*from* Author's abstract

00131 **Forgotson, James M., Sr.** Indication of proximity of high pressure fluid reservoir, Louisiana and Texas Gulf Coast: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 171–173, 1969.

The writer suggests that a method is available to Gulf Coast operators for detecting the proximity of high-pressure fluid reservoirs in drill holes. The presence of high background gas and high trip gas, together with lower than normal shale density, has been reported by mud logging companies to signify the proximity of a high-pressure fluid reservoir. The writer found that low-density shales are not necessarily accompanied by background gas or trip gas, or even low resistivities on electric logs, but that a minimum increase of 200 percent in the shale penetration rate indicates that a high-pressure reservoir is nearby.—HWR

06069 **Forsyth, Jane L.** Glacial geology of the West Mansfield quadrangle, Logan and Union Counties, Ohio: Ohio Div. Geol. Survey Rept. Inv. 69, 1 sheet, scale 1:24,000, text, 1968.

Most of the West Mansfield area is covered with a thick mantle of late Wisconsin age glacial deposits over deeply buried bedrock which is mainly Devonian Columbus Limestone, except in the eastern part where it is Silurian Tymochtee Formation. The Marysvale Till has a high clay content, the probable result of an ice-dammed lake present briefly to the north. Two end moraines are separated by broad areas of ground moraine; boulders are present, occurring in greatest numbers on and north of the Broadway Moraine. The buried bedrock surface slopes gently northeastward from the steep Bellefontaine outlier; two straight, narrow valleys, which deepen toward the northeast, are present. One small deposit of dirty, poor quality, and difficult to work gravel has been recognized.—MCM

00167 **Foster, Helen L.** Asbestos occurrence in the Eagle C-4 quadrangle, Alaska: U.S. Geol. Survey Circ. 611, 7 p., illus., 1969.

An asbestos occurrence was discovered in a remote part of the Eagle quadrangle, Alaska, in the summer of 1968 during geologic reconnaissance. The exposed part of the deposit consists of large joint blocks of serpentine, cut by closely spaced

subparallel veins which are about 1/4 inch thick and consist of cross-fiber chrysotile asbestos. The asbestos appears to be of commercial quality, but the total quantity is unknown; it occurs in a serpentinized ultramafic mass which appears to intrude metamorphic rocks. Many other such mafic masses are known in the Eagle quadrangle but this is the first in which considerable asbestos has been found. The deposit is of importance because it shows that geologic conditions are locally favorable for asbestos in the Yukon-Tanana Upland, and hope of finding commercial deposits thus seems possible.—*from* Author's abstract

Foster, John H. *See* Smith, John D. 00143

00260 **Freedman, Jacob.** Geochemical prospecting investigations in the Lancaster Valley, Piedmont of southeastern Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 20, 1969.

05865 **Freeman, Val L.** Geology of the Comstock-Indian Wells area, Val Verde, Terrell, and Brewster Counties, Texas: U.S. Geol. Survey Prof. Paper 594-K, p. K1-K26, illus., table, 1968.

The Comstock-Indian Wells area lies astride the northern end of the Rio Grande Embayment. The rocks mapped and described include two units of Early Cretaceous age, four formations of Late Cretaceous age, and four units of Quaternary age. The Cretaceous rocks are dominantly marine limestones that were deposited in a shallow shelf environment. Post-Cretaceous rocks are stream deposits, mostly gravels. Structurally, the area was affected by the folding and accompanying faulting and jointing of the Mexican Highland to the west and of the Edwards Plateau to the north and east. Subsidence areas of unusual size and number are attributed to solution at depth accompanied and followed by downwarping and collapse of the overlying rocks.—VLF

00211 **Friedman, Gerald M.** Recognizing tidal environments in carbonate rocks with particular reference to those of the Lower Paleozoics in the northern Appalachians [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 20-21, 1969.

Friedman, Gerald M. *See* McKinney, T. F. 00231

Fullagar, P. D. *See* Dietrich, R. V. 00102

06054 **Fullagar, Paul D.; Bottino, Michael L.** Geochronology of Silurian and Devonian age volcanic rocks from northeastern North America, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 6, Geochemistry: Prague, Academia, p. 17-32, illus., tables, 1968.

The following geologically well-dated volcanics from five localities in northeastern North America have been studied using the whole-rock Rb-Sr age method: (1) The Arisaig volcanics from Arisaig, Nova Scotia, have a minimum age of Lower Silurian (430 m.y.); (2) the Lower Devonian Eastport Formation volcanics and the Hedgehog formation volcanics from Maine give a minimum age of 413±5 m.y. for the Silurian-Devonian boundary; (3) the upper Lower to lower Middle Devonian Kineo volcanics and the Traveler volcanics from Maine have ages of 365 ± 15 m.y. and 357 ± 10 m.y., respectively. Comparison of these results indicates that the Silurian in northeastern North America was approximately 20 m.y. long; this is shorter than suggested by recent time-scale estimates. The Lower Devonian in northeastern North America may have been approximately 50 m.y. long.—KAF

06331 **Gabert, G. M.; Roed, Murray A.** Bedrock topography and surficial aquifers, Edson area, Alberta: Research Council Alberta Rept. 68-1, 9 p., illus., 1968.

The surficial deposits in the Edson area have a complex origin. Potential surficial aquifers are found in buried-valley deposits, glacial meltwater channel deposits, glacial outwash sands, aeolian deposits, and alluvial deposits. The most significant surficial aquifer—a buried-valley aquifer consisting mainly of gravel—has been extensively investigated. The estimated 20-year safe yield of a single well located in the southeast section of Edson and complete in this gravel is 225 imperial gallons

per minute; average safe yields for individual wells in a well-field development would be reduced from this figure, partly because of interference among wells and partly because the aquifer appears to have a lesser potential at other locations. The Edson buried-valley aquifer is, nevertheless, potentially a major source of water for the area.—Authors' abstract

00212 **Galey, John T.** Role of the geologist in environmental planning [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 21–22, 1969.

00145 **Garrels, Robert M.; Mackenzie, Fred T.** Sedimentary rock types—Relative proportions as a function of geological time: Science, v. 163, no. 3867, p. 570–571, illus., 1969.

Proportions of sedimentary rock types remaining today differ from period to period. These differences may be chiefly the result of differential rates of deposition and erosion of the various components of the rocks. Lower percentages of limestones and evaporites in Precambrian rocks than in post-Precambrian rocks probably represent selective loss of these more easily removable components from the original deposits.—Authors' abstract

Garske, David H. *See* Kernaghan, James S. 05873

05874 **Garske, David H.** Mineralogy of the lower contact zone of the Double Rainbow mine, Galena, South Dakota, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 177–178, illus., 1968.

The occurrence of silver with its oxides or galena is described. The ore, two horizons near the top and near the bottom of the Deadwood Formation, usually localized near vertical fractures in a dolomitic rock, is quite vuggy and unoxidized in comparison with the other ores in the district. Minerals include: arsenopyrite, chalcopyrite, galena, kaolinite, pyrite, pyrrhotite, siderite, sphalerite, and tetrahedrite.—HRC

05886 **Gast, Paul W.** Upper mantle chemistry and evolution of the Earth's crust, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies,1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 15–27, illus., tables, 1968.

Isotopic and chemical data indicate that the mean composition of the Earth differs from that of carbonaceous chondrites in being characterized both by a depletion of certain volatile elements and an enrichment of refractory elements relative to the meteorites. Chemical differentiation of the Earth has been less extensive than generally postulated, and differences in chemistry between the suboceanic and subcontinental mantle material are significantly less than presently accepted heat flow models suggest.—MS

05999 **Gates, Robert M.; Martin, Charles W.; Cassie, Robert M.** The bedrock geology of the Waterbury and Thomaston quadrangles, Trip D-5 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 12 p., paged separately, illus., 1968.

Seventeen field trip stops are outlined,each showing different aspects of the geology of the area. The Waterbury Formation, a complex metasedimentary gneiss, forms the core of the Waterbury mantled gneiss dome. The Hartland Formation mantles the dome and is divided into three distinct units: the lowest is a mica-plagioclase quartz granulite and granulitic gneiss; the middle is the Hitchcock Lake Member of quartzo-feldspathic granulites and micaceous quartz gneisses and schists; the upper, the Straits Schist Member, is a muscovite-plagioclase-quartz schist with porphyroblasts of garnet and kyanite. Amphibolites are present in all of the members and may be syntectonic or metavolcanics. Granitic sills are present also in the Hartland Formation.—HRC

Gates, Robert M. *See* Bowser, Carl J. 06188

00213 **Gaudette, H. E.; Bothner, W. A.** Geochemistry of the Belknap Mountain ring complex, New Hampshire [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 22, 1969.

06025 **Gazin, C. Lewis.** A study of the Eocene condylarthran mammal *Hyopsodus*: Smithsonian Misc. Colln., v. 153, no. 4 (Pub. 4744), 90 p., illus., 1968.

A complete study of this mammal is given. Most of the material comes from the Bridger Formation in Wyoming, although it is known from other locations in the Rocky Mountain region from New Mexico to Saskatchewan. There are twelve species in the genus—five in the lower, five in the middle, and two in the Upper Eocene. Many fragments and skeletons are discussed in great detail.—HRC

Gearhart, Marvin. *See* Hawkins, William K. 05919

06074 **Georgia Geological Society; Herrick, S. M.; Counts, H. B.** Late Tertiary stratigraphy of eastern Georgia—Guidebook for 3d annual field trip, 1968: [Carrollton, Ga.] West Georgia College, 88 p., illus., 1968.

The field trip begins at Augusta and parallels the Savannah River valley to Stony Bluff Landing. Formational overlap and interformational facies change are considered chiefly responsible for stratigraphic and lithologic changes in Tertiary deposits in updip areas. Principal stratigraphic changes are overlap of: Paleocene and early Eocene deposits by middle Eocene McBean Formation, McBean by late Eocene Barnwell Formation, and Barnwell and Ocala Limestone by Oligocene deposits. Progressive facies change has taken place along strike in a northeasterly direction as well as updip and within the formation, involving a lithologic change from clays and limestones of downdip areas to predominantly sand beds in updip areas which seem to represent possible shorelines of diverse units readily distinguishable in downdip areas.—*from* Authors' summary

Gerard, C. J. *See* Hipp, Billy. 05957

06120 **Gershanovich, D. E.** New data on geomorphology and recent sediments of the Bering Sea and the Gulf of Alaska: Marine Geology, v. 6, no. 4, p. 281–296, illus., 1968.

Data on bottom relief and sedimentary processes in the Bering Sea and Gulf of Alaska obtained by Soviet oceanographic research vessels in the period 1958–64 are summarized. Continental shelves are epicontinental and geosynclinal; the slopes exhibit a ledge at 2,500 m deep and an inclined plane at the foot of which is a main area of sedimentation; Shirshov and Bowers ridges divide the Bering Sea abyssal plain; the Komandor–Aleutian Island arc includes the Bering Sea and Pacific Ocean slopes and relief forms of the Aleutian Trench; and the Gulf of Alaska is complicated by volcanoes. Sediments exhibit great variation in composition (terrigenous, diatomaceous, and terrigenous volcanogenic and organogenic) and distribution. Recent sedimentation rates vary from 2 to 30 cm per 1,000 yr on the Bering Shelf and on lower slopes may reach 40 cm.—VSN

06016 **Giblin, P. E.** Notes on mineral occurrences, Hornepayne sheet, Map P.476, Geological Compilation Series: Ontario Dept. Mines Misc. Paper 20, 19 p., 1968.

This report presents brief summary descriptions of the mineral occurrences shown on the Hornepayne Sheet, Map P.476 (Giblin, 1968) [*See* Abstracts of North American Geology, October 1968]. It is hoped that these notes will assist map-users in assessing the merits of the mineral occurrences shown on the map. Author's introduction

Gibson, Thomas G. *See* Buzas, Martin A. 00139

Gilbert, R. L. G. *See* Brooke, John. 06337

06316 **Gillott, Jack E.** Clay in engineering geology: Amsterdam, London, New York, Elsevier Publishing Co., 296 p., illus., tables, 1968.

This interdisciplinary text introduces geologists and mineralogists to the terminology and literature on some aspects of soil mechanics, and engineers to pertinent information on geology and mineralogy related to clay. The first three chapters deal with classification and origin of clays; 4 and 5, with their mineralogy, fabric, and physical chemistry; 6, with moisture interaction; 7, modern views on their deformation and strength properties; 8, methods for improving engineering properties of clay soils; 9, importance of clays as raw materials, overlapping with industrial mineralogy and ceramic engineering; and the last three, with most commonly used methods of mineralogical, physical, and engineering analysis, assuming experience with X-ray diffraction. Principles which underlie clay behavior are summarized.—GDC

00094 **Gilvarry, J. J.** Geometric and physical scaling of river dimensions of the Earth and Moon: Nature, v. 221, no. 5180, p. 533–537, illus., table, 1969.

One purpose of this article is to determine how the mensuration and hydrodynamics of a river change when some parameter such as length varies. The effect of gravity appears explicitly in the theoretical results. The development thus permits scaling the dimensions of a terrestrial river directly to its lunar homolog. The resulting prediction of vestiges of rivers quantitatively supports the concept of lunar maria as vanished seas. This work also fills a gap in the geologic literature by putting on a firmer basis the fundamental relations of the hydraulic geometry of terrestrial rivers.—DBV

Givens, W. W. *See* Hilchie, D. W. 05951

Godfry, Andrew E. *See* Cleaves, Emery T. 00209

Goldberg, Edward D. *See* Griffin, John J. 05986

Goldberg, Moshe. *See* McKee, Edwin D. 00111

06071 **Golder, H. Q.; Osler, J. C.** Settlement of a furnace foundation, Sorel, Quebec [with French abs.]: Canadian Geotech. Jour., v. 5, no. 1, p. 46–56, illus., table, 1968; closure to discussion, ibid., no. 4, p. 250–252, illus., 1968.

A smelter is located in an area underlain by about 80 feet of compact stratified sand, silt, and clay, followed by at least 150 feet of Leda clay. Settlement records spanning 15 years are available for the five original furnaces built in 1950–52. No. 1 Furnace is to be replaced by a new unit weighing about twice as much as the original. A settlement analysis of the existing foundation was undertaken and agreed with observed settlement. Predictions of rebound during demolition and an estimate of the settlement of the new furnace were made. A significant feature of the problem is that a large portion of the total settlement to date is due to consolidation of the Leda clay.—*from* Authors' abstract

06047 **Goldsmith, Richard; Dixon, H. R.** Bedrock geology of eastern Connecticut, *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 9 p. (F–O), paged separately, illus., table, 1968.

Eastern Connecticut is underlain by metasedimentary, metavolcanic and plutonic rocks of Precambrian(?) and early to middle Paleozoic age. Metamorphism is medium to high grade over most of the area and structural relationships are complex. The Taconic(?), Acadian, and Alleghenian orogenies have affected the area to a greater or lesser extent. The only definite age for the metamorphic rocks is pre-Permian or pre-Pennsylvanian; the age of the rocks otherwise is known only in a general way. The plutonic rocks are gneiss, and are late tectonic, syntectonic, or pretectonic. Gabbro bodies are among the youngest rocks of the area. Various structural features are outlined.—HRC

06056 **Goles, Gordon G.** Rare-earth geochemistry of Precambrian plutonic rocks, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 6, Geochemistry: Prague, Academia, p. 237–249, illus., table, 1968.

Previous studies of Precambrian sedimentary rocks indicate that little or no change has occurred in the typical relative abundance pattern of rare-earth elements found in sedimentary rocks during at least the past 2 b.y. The hypothesis that the typical sedimentary rare-earth abundance pattern is a reflection of the geochemical cycle operating throughout geological time is called into question. Analyses of rare earths, in plutonic rocks from South Africa about 3 b.y. old, were performed by an instrumental activation analysis technique. Results are compared with those on younger rocks of similar types from various locations. Such comparisons imply that the mechanism by which the typical sedimentary rare-earth pattern is generated from a presumed chondritic-like initial pattern, may be connected closely with igneous differentiation processes. Some speculations are presented on the detailed nature of this mechanism.—*from* Author's abstract

06006 **Goll, R. M.** Classification and phylogeny of Cenozoic Trissocyclidae (Radiolaria) in the Pacific and Caribbean Basins, Pt. I: Jour. Paleontology, v. 42, no. 6, p. 1409–1432, illus., 1968.

Trissocyclid Radiolaria from 54 samples of Eocene to Quaternary age, including deep sea cores from the Pacific and outcrops in the Antilles, are described and illustrated. The family Trissocyclidae is raised from subfamily rank and emended to include members of the suborder Nassellarina that have sagittal rings. Skeletal morphology is described. Seven evolutionary lineages are arranged in five emended genera. The genera *Dendrospyris* and *Liriospyris* are emended and 9 (5 new) and 10 (6 new) species, respectively, described herein.—JWH

00214 **Goodspeed, Robert M.** The origin of myrmekite in the Precambrian plutonic granites in a portion of the New Jersey Highlands [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 22–23, 1969.

00215 **Goodwin, A. M.** Archean volcanic belts [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 23–24, 1969.

00246 **Gould, James P.** Geology and the construction on the metropolitan Washington, D.C., rapid transit system [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 24, 1969.

Graham, K. *See* Kunze, R. J. 05966

05932 **Graph, R. B.** The system Ag_2AuS_2–Ag_2S: Am. Mineralogist, v. 53, nos. 3–4, p. 496–500, illus., table, 1968.

The system was studied by DTA and electrical resistivity to 200°C and the phase diagram was determined from the data. The eutectic on the binary was found to be at 113° and 45 mole percent Ag_2S.—JLH

Gray, Fenton. *See* Culver, James R. 05963

Gray, K. E. *See* Podio, A. L. 06334

06057 **Greenwood, H. J.** Matrix methods and the phase rule in petrology, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 6, Geochemistry: Prague, Academia, p. 269–279, illus., tables, 1968.

An assemblage of homogeneous minerals may be characterized by the matrix which gives the proportions of every constituent of every phase as an indexed element of the matrix. The Gibbs phase rule may be tested with the characteristic matrix. Regression techniques have been employed in an application of this approach to some naturally occurring mineral assemblages, and the phase rule is viewed from this standpoint. It is shown that more confidence can be placed in analytical solution than in comparable graphical solutions, and that it is possible to identify any linear dependence in a mineral assemblage. The absence of significant linear dependence

indicates that the phase rule of Goldschmidt is obeyed, and conversely. It is suggested that this is the only satisfactory way to apply the phase rule to natural assemblages of minerals.—*from* Author's abstract

Gregory, A. R. *See* Podio, A. L. 06334

Gries, J. P. *See* Shapiro, L. H. 05875

05882 **Gries, J. P.** Second day of field conference, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 227–229, 1968.

The 119-mile long trip begins at Deadwood, S.D., goes to Sturgis, Fort Meade Reservoir, Blackhawk, Sitting Bull Cavern, Keystone, Mount Rushmore, Hill City, Nemo (optional), Pluma, and back to Deadwood. The geological features to be seen along the way are listed.—HRC

05880 **Gries, John Paul; Crooks, Thomas J.** Water losses to the Madison (Pahasapa) limestone, Black Hills, South Dakota, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 209–213, illus., table, 1968.

Six streams flowing eastward from the Black Hills show significant water losses where they cross the outcrop of the Madison Limestone. Gaging indicates that there is a free interchange of flow between the surface channel, the alluvium, and the passages in the underlying limestone. The result, in every case, however, is a net gain by the artesian system of the limestone. The excess water which cannot be absorbed by the artesian system leaks back to the surface as springs. Sinkholes and caverns are a large part of the area of the Madison over which the water flows.—HRC

05986 **Griffin, John J.; Windom, Herbert; Goldberg, Edward D.** The distribution of clay minerals in the World Ocean: Deep-Sea Research, v. 15, no. 4, p. 433–459, illus., tables, 1968.

The relative amounts of chlorite, montmorillonite, kaolinite and illite in the less than 2 micron size fraction of pelagic sediments are related to sources and transport paths of solid phases from the continents to the oceans and to injections of volcanic materials to the marine environment. Three modes of entry of solid phases from the lands to the seas are considered: by glaciers, by rivers and by atmospheric winds. The compositions of the clay size fraction are also related to rates of accumulation of the non-biogenous phases.—Authors' abstract

Griffiths, John C. *See* Ondrick, Charles W. 00226

00092 **Gross, M. Grant; Milliman, John D.; Tracey, Joshua I., Jr.; Ladd, Harry S.** Marine geology of Kure and Midway atolls, Hawaii—A preliminary report: Pacific Sci., v. 23, no. 1, p. 17–25, illus., tables, 1969.

Midway and Kure islands, the world's northernmost atolls, have flourishing algal-coral reefs with typical structures. A circular outer reef and a broad, shallow, sediment-built lagoon terrace surround the deeper parts of each lagoon. Unconsolidated carbonate sand and gravel form islands along the southern margins, and patch reefs form intersecting ridges partly covered by sediment. Emergent parts of older reef rock, built of coralline algae, are especially well developed on Midway. Sediment grain size decreases lagoonward. Carbonate gravel and coarse sands predominate on reef flats, on seaward sides of islands, and on the lagoon terrace. Fine carbonate sands and silts cover the deeper part of the lagoon bottom. Major contributing organisms are: coralline algae, corals, foraminifers, and mollusks. Most sediment grains are reef-derived; there is no distinctive lagoonal sediment facies.—*from* Authors' abstract

00247 **Grossman, I. G.** Waterborne styrene in a bedrock aquifer in the Ledyard area, southeastern Connecticut [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 24–25, 1969.

05907 **Guess, Roy H.; Swirczynski, R. P.** Muddy exploration, 1887–1968, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 41–46, illus., table, 1968.

A history of the petroleum production from the Cretaceous Muddy Sandstone in northeastern Wyoming and southeastern Montana is reviewed. Examples of electrical log appearances and a table showing drilling activities are included.—HRC

05909 **Haddenhorst, Fred A.** Development history—Bell Creek field, Powder River County, Montana, June 1967 to July 1968: Jour. Petroleum Technology, v. 20, no. 8, p. 787–793, illus., tables, 1968; *reprinted in* Black Hills area, S.D., Mont., Wyo.—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 59–65, 1968.

The field is in the southeastern corner of the county just north of Wyoming, on the northeastern flank of the Powder River basin adjacent to the western margin of the Black Hills uplift. The producing sand is developed in the upper Muddy zone and oil accumulation is the result of stratigraphic traps in updip pinchouts. Present evidence suggests that the reservoir is a river-mouth bay complex. The Muddy Sandstone is white, very fine grained, subrounded, soft, friable, has scattered thin shale laminations, and contains varying amounts of clay filling, particularly in the upper portion of the pay zone. Cores show a gradational contact with the underlying Skull Creek Shale, and at least three productive lenses of sand are present. Numerous technical details of development are described.—HRC

05982 **Hail, William J., Jr.** Geology of southwestern North Park and vicinity, Colorado: U.S. Geol. Survey Bull. 1257, 119 p., illus., tables, geol. maps, 1968.

The area lies on the west flank of the North Park–Middle Park structural basin. Precambrian crystalline rocks consist of quartz monzonite gneiss and quartz monzonite. Sedimentary rocks, aggregating 16,000 feet in maximum thickness, range in age from Permian to Miocene, and comprise the Chugwater, Sundance, Morrison, Dakota, Benton, Niobrara, Pierre, Coalmont, and North Park Formations. A major pre-Paleocene unconformity separates the Coalmont Formation from older rocks. Igneous rocks of Oligocene to Miocene or Pliocene age comprise the extrusive Rabbit Ears Volcanics, younger extrusive rocks, and numerous intrusive bodies. Pleistocene and Recent surficial deposits include glacial drift, block slides, various gravels, landslides, and alluvium. The Coalmont has yielded large amounts of coal. Gravel resources are abundant.—WJH

Haimovitz, Allen. *See* Taft, William H. 06319

00146 **Halbouty, Michel T.** Hidden trends and subtle traps in Gulf Coast: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 3–29, illus., 1969.

The alarming decline in the number and value of hydrocarbon discoveries suggests that most of the "traditional" and easy-to-find hydrocarbon traps have been found. Unless new exploration concepts and methods are developed (and supported by management), many hidden traps below unconformities or associated with buried landscapes and structures may never be discovered. The key to discovering these hidden traps is in reconstructing the stratigraphic, paleotectonic, paleogeographic, paleogeomorphic, and paleoenvironmental histories of likely regions. Examples from the Gulf coastal province illustrate trap situations disclosed by these fundamental geologic studies.—BHK

06133 **Halbouty, Michel T.** Shale oil—Will it ever be a reality? *in* Fifth symposium on oil shale: Colorado School Mines Quart., v. 63, no. 4, p. 127–134, 1968.

The oil shale in Colorado alone has been estimated at 1.5 trillion bbl. The minable portion which averages 25 gallons per ton is estimated to contain 480 billion bbl of oil of which 60 percent or 280 billion bbl might be recovered by present day technology. Oil shale can best be developed by private enterprise.—KAF

05972 **Haley, Boyd R.** Geology of the Scranton and New Blaine quadrangles, Logan and Johnson Counties, Arkansas: U.S. Geol. Survey Prof. Paper 536-B, p. B1-B10, illus., tables, geol. map, 1968.

The Scranton and New Blaine quadrangles, in west-central Arkansas, are underlain by sedimentary rocks of Devonian(?) to Middle Pennsylvanian age which have been folded into eastward-trending synclines and anticlines and broken by normal faults. Structural relief, measured on the base of the Hartshorne Sandstone is 2,500 feet. Coal occurs in the Atoka, McAlester, and Savanna Formations but only the Lower Hartshorne coal bed within the McAlester is economically important. A small amount of natural gas has been produced from the Atoka Formation. Building stone and road metal have been obtained from the Savanna, McAlester, Hartshorne, and Atoka Formations and from alluvial deposits.—BRH

06000 **Hall, Leo M.** Geology in the Glenville area, southwesternmost Connecticut and southeastern New York, Trip D-6 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 12 p., paged separately, illus., 1968.

A field trip of five stops in 27 miles, intended to illustrate the stratigraphy and structure of the area as currently understood, is outlined. Three major bedrock groupings are discussed: the Precambrian Yonkers Gneiss-Fordham Gneiss; Cambrian-Ordovician miogeosynclinal Lowerre Quartzite, Inwood Marble, Manhattan Schist; and the probable Cambrian-Ordovician eugeosynclinal Hartland Formation-Harrison Gneiss. The stratigraphic relations are discussed, inasmuch as three different hypotheses have been proposed. Multiple deformation is evident. An isoclinal fold was later refolded after the deposition of the Hartland Formation. The results of multiple deformation are also abundant in the Precambrian gneisses and in the miogeosynclinal sequence.—HRC

06154 **Hamblin, W. Kenneth; Rigby, J. Keith.** Guidebook to the Colorado River, Pt. 1—Lee's Ferry to Phantom Ranch in Grand Canyon National Park—Studies for students, No. 4: Brigham Young Univ. Geology Studies, v. 15, pt. 5, 84 p., illus., 1968.

This guidebook outlines a self-conducted boat trip down the Colorado River for study of a classic cross section in the Earth's crust. All points are made with reference to Lee's Ferry; illustrations include vertical aerial photographs. In the River log are brief descriptions of major features in each formation, from Precambrian through Jurassic, discussions of how the rocks respond to erosion, and interpretations of their depositional environments. An arid region of horizontal strata, exceptional buttes and other erosional forms are noted; during sudden storms, weathered rock debris moves swiftly to the sea. A monoclinal flexure brings easily eroded shales to river level at Lee's Ferry, along the only feasible crossing site in hundreds of miles.—GDC

Hamil, M. M. *See* Kupfer, D. H. 06111

Hamilton, J. J. *See* Burn, K. N. 06050

00248 **Hand, Bryce.** Antidunes as trochoid waves [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 25, 1969.

00105 **Hansen, Harry J.** A geometric method to subdivide the Patapsco Formation of southern Maryland into informal mapping units for hydrogeologic use: Geol. Soc. America Bull., v. 80, no. 2, p. 329-336, illus., 1969.

Perspective geometry is applied to divide the Patapsco Formation (Lower Cretaceous) in Maryland into upper, middle, and lower mapping units. The area of study is further divided laterally into arbitrary units each 13.5 miles wide. Data from electric and lithologic logs are applied to derive average sand percentages for each "slice" of the heterogeneous aquifer. Transmissivity values are assigned to each slice on the basis of limited aquifer-test data published earlier by various authors. To maximize hydraulic gradient, it is assumed to coincide with slope on

the top of each mapping unit. The modified Darcy equation Q=TIL is applied to each unit. Summing results of the calculations implies that nearly 100 × 10^6 gpd moves through a 54-mile width of aquifer.—JHF

Harbaugh, John W. *See* Bonham-Carter, Graeme. 06170

06125 **Harmsworth, Rodney V.; Whiteside, Melbourne C.** Relation of cladoceran remains in lake sediments to primary productivity of lakes: Ecology, v. 49, no. 5, p. 998–1000, illus., tables, 1968.

Cladoceran microfossil remains from the surficial sediments of 19 Danish and 14 Indiana lakes were analyzed quantitatively. An attempt was made to correlate the number of remains with C-14 primary productivity measurements by previous authors. The Spearman rank correlation method gave no correlation for lakes in different drainage basins. It is suggested that under special circumstances [as in the case of the Madison Wis., lakes] there may be a correlation when only lakes of the same drainage basin are considered.—Authors' abstract

00106 **Harper, Charles W., Jr.; Boucot, A. J.; Walmsley, V. G.** The rhipidomellid brachiopod subfamilies Heterorthinae and Platyorthinae (new): Jour. Paleontology, v. 43, no. 1, p. 74–92, illus., tables, 1969.

Heterorthinae is revised to include plano-convex to concavo-convex rhipidomellids typically with a long hinge line and a high, bladelike, simple cardinal process *Heterorthis, Heterorthella* n.g., and questionably *Svobodaina, Heterorthina*, with age range of Llandeilian through Wenlockian. Platyorthinae, n.subfam. is proposed to include plano-convex rhipidomellids with a short hinge line and a cardinal process which is either trilobed or proximally bilobed and trilobed or quadrilobed on its distal face; it includes: *Diceromyonia* of Ashgillian age; *Marklandella* n.g., Wenlockian-Ludlovian, with new species *M. giraldi and M. macadamica; Platyorthis*, Pridolian-Eifelian.—*from* Authors' abstract

00249 **Harper, J. D.** Development of nearshore and coastal carbonate environments, Late Silurian-Early Devonian, New York State [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 25–26, 1969.

00250 **Harrington, Jonathan W.** Morphogenesis and autecology of the New York Senecan (Upper Devonian) Rhynchonellida (Brachiopoda) [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 26, 1969.

00123 **Harrison, Jack E.; Reynolds, Mitchell W.; Kleinkopf, M. Dean; Pattee, Eldon C.** Mineral resources of the Mission Mountains Primitive Area, Missoula and Lake Counties, Montana: U.S. Geol. Survey Bull. 1261-D, p. D1–D48, illus., tables, geol. map, 1969.

The area encompasses about 118 sq mi of the rugged Mission Range, formed in the slightly metamorphosed Precambrian Belt Supergroup that is intruded sparsely by quartz diorite of probable Tertiary age. Precambrian rocks are broken by a few faults and gently folded in places, but these features do not significantly interrupt the uniform northward strike and gentle eastward dip of the rock layers. Geologic examination along several hundred miles of foot traverses, semiquantitative spectrographic and chemical analyses of about 500 samples of bedrock and stream sediments, and an aeromagnetic survey did not reveal any mineral deposits of economic significance. The lack of hydrothermal alteration in rock layers or along faults indicates mineralizing solutions have not affected the area significantly.—*from* Authors' abstract

Hasan, Zia-ul. *See* Wynne-Edwards, H. R. 00185

00088 **Hasofer, Abraham M.** Probabilistic models for seismic force design [discussion of paper 5950 by J. R. Benjamin, 1968]: Am. Soc. Civil Engineers Proc., v. 95, paper 6325, Jour. Structural Div., no. ST 1, p. 133–136, 1969.

Benjamin (ibid., v. 94, no. ST 5, p. 1175–1196, 1968) does not make clear the assumptions underlying the Bayesian approach to probability; Hasofer outlines the

essential steps and considers the choice of an *a priori* distribution for the parameters. In the case of seismic force design, the only parameter considered is the rate of occurrence of earthquakes. Finally, the multinomial model for distribution of intensities, which Benjamin claims to be an improvement on the model of a separate, independent Poisson process for each intensity, is considered. According to Hasofer, the two are identical.—ESL

00112 **Hatherton, Trevor.** Geophysical anomalies over the eu- and miogeosynclinal systems of California and New Zealand: Geol. Soc. America Bull., v. 80, no. 2, p. 213–229, illus., table, 1969.

Geophysical anomalies which occur over the junction of eu- and miogeosynclinal facies, and over miogeosynclinal sediments, indicate virtually continuous belts of mafic and ultramafic rocks between the shallow- and deep-water facies. Serpentine and andesite have the physical properties to explain the anomalies, and chemically similar andesites, younger than the sediments, appear as outcrops on the crests of the anomalies. The similarity of possible ultramafic and andesite occurrences in the Tasman Basin–Macquarie Ridge–Solander Trough system, at present devoid of sediments, to those of California and New Zealand systems, leads to the hypothesis that an ultramafic-cored ridge predates sedimentation and acts as a buffer between the two types of sediments during the orogenic phase.—*from* Author's abstract

00251 **Hatheway, Richard B.** Cataclastic rocks in southwestern Maine [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 26–27, 1969.

Havard, C. J. *See* Irish, E. J. W. 06312

05919 **Hawkins, William K.; Gearhart, Marvin.** Use of logging in uranium prospecting, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 131–139, illus., 1968.

Wide range gross count gamma probes are now available for recording the count rate of wide grades of uranium ore with other logs being used for specialized study. Properly calibrated systems are being used for gross count quantitative evaluation of the ore bodies. Experimental data available in field spectral logging has helped define the limitations of existing equipment. The use of coaxial type transmission logging cables and field use of new solid state detectors are expected to advance spectral well logging in the future. New and different probe designs are being developed that will help to establish areas that will be more favorable for deposits of uranium ore.—Authors' conclusions

06108 **Hedberg, Hollis D.** Some matters of concern to the petroleum industry with respect to public policy on mineral resources of the world ocean, *in* Mineral resources of the world ocean—Symposium, Newport, R.I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, p. 88–95, 1968.

The petroleum industry has the technical capability for geological and geophysical exploration in the deep oceans, and can soon develop the technology to produce at water depths of >1,000 m. Governmental jurisdiction over such areas must be planned. The Geneva Convention on the Continental Shelf defines oceanward limits of coastal-nation jurisdiction rather vaguely, based mainly on exploitability limits. The natural and logical guide should be not the edge of the geomorphic continental shelf but the zone of continental-oceanic crustal transition, just oceanward of the base of the slope. Each coastal state should fix its own political boundaries with reference to this zone. U.S. domestic policy is discussed; present leasing laws are criticized for inadequacy in encouraging development of large, unproved offshore areas such as the Atlantic continental margin.—VMJ

06026 **Hedges, Lynn S.** Geology and water resources of Beadle County, South Dakota—Pt. 1, Geology: South Dakota Geol. Survey Bull. 18, pt. 1, 66 p., illus., tables, geol. maps, 1968.

In the James River basin at the south end of the glacial Lake Dakota plain, eastern tributaries are deeply incised; western ones have broad valleys deepening near the

river. The Precambrian granitic basement and dissected Sioux Quartzite ridge are beneath Cretaceous formations as much as 1,400 feet thick: Dakota Group, Graneros Shale, Greenhorn Limestone, Carlile Shale, Niobrara Marl, and Pierre Shale. A thin basal drift and overlying lacustrine sequence up to 400 feet thick may be pre-Wisconsin, early Wisconsin outwash is buried in deep bedrock drainage channels, and extensive late Wisconsin drift averages 35 feet thick. Landforms indicate that the Wisconsin ice margin halted four times during deglaciation. Ground water, sand and gravel are the major mineral resources.—GDC

05913 **Hegna, Earl T.** South Coyote Creek field, Wyoming, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 83–88, illus., 1968.

The Fall River Formation had produced 603,965 bbl of oil as of April 1, 1968. Since the Fall River has only a forty-foot oil column, water production increased rapidly after completion of the wells. The Turner sandstone has produced a total of 891,656 bbl of oil as of June 1, 1968. The South Coyote Creek field is a small oil field, but it is one of the few dual-pay pools on the east flank of the Powder River basin. The Fall River pool is typical of other pools in the trend and data from it demonstrated the reservoir continuity of the Fall River trend. The Turner production illustrates that Upper Cretaceous sands have hydrocarbon potential wherever adequate reservoir conditions are found.—Author's conclusions

06317 **Heigold, Paul C.** Notes on the earthquake of November 9, 1968, in southern Illinois: Illinois Geol. Survey Environmental Geology Notes, no. 24, 16 p., illus., table, 1968.

On the morning of Nov. 9, 1968, an earthquake shook a large area of central and southeastern United States, extending from Nebraska to North Carolina and from Michigan to the Gulf of Mexico. It was centered in southern Illinois, northwest of Broughton in Hamilton County, about 107 mi northeast of New Madrid, Mo., where the largest earthquake in the history of the continental United States was centered in 1811. Its epicenter, at the southern end of the Fairfield basin, in several zones of faulting, falls within a magnetic high; focal depth was about 12 mi. Gravity and aeromagnetic maps are included, and several possible triggering mechanisms are listed. A canvass revealed no major damage outside the epicenter.—ESL

06017 **Heintze, Carl.** The circle of fire—The great chain of volcanoes and Earth faults: New York, Meredith Press, 161 p., illus., 1968.

The "circle of fire", the great chain of faults, submarine trenches, and volcanoes rimming the Pacific, can be described geographically by tracing its path from Alaska and back, or by counting the active volcanoes which dot its course, or by following the lines of established faults, or the great system of deep ocean trenches. Although all catastrophic events have been accounted for during recorded history, the number probably runs into the millions. Chapter headings in this popular account are: beginning of the circle; fire, ash, and mud; shakes and quakes; tsunamis, swashes, and waves; soundings, sea bottom, and magnets; and predictions of things to come. The modified Mercalli scale, a suggested reading list, and an index are appended.—MCM

05900 **Heirtzler, J. R.** Evidence for ocean floor spreading across the ocean basins, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 90–100, illus., 1968.

The symmetrical distribution of linear patterns of magnetic anomalies relative to the axes of the Mid-Atlantic Ridge and other oceanic ridges suggests that the ocean floor may be spreading outwardly near the axis of the midocean ridge system. The mechanics of the motion is problematic in several respects, particularly the apparent absence of reorientation during lateral movement of the magnetized material and the absence of a large trench at the terminus of the lateral movement.—MS

06126 **Heirtzler, J. R.** Sea-floor spreading: Sci. American, v. 219, no. 6, p. 60–70, illus., 1968.

This semi-popular article is an attempt to synthesize data on sea-floor spreading, geomagnetic-field reversals, earthquakes, and continental drift.—DWR

06095 **Heising, Leonard F.; Renick, Abbott.** Big Walnut Reservoir site, Putnam County, Indiana—Mineral resource survey, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V. 2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 343–350, illus., 1968.

The proposed reservoir lies within the Tipton Till Plain which is characteristic of a modified ground moraine plain. Bedrock at the damsite consists of the Harrodsburg Limestone and the underlying Edwardsville Formation of the Borden Group. Limestone and sand and gravel are the only known mineral deposits along the Big Walnut Creek on the site of the proposed reservoir. The limestones are suitable for manufacturing cement, but ample reserves are located closer to the existing cement plant in Putnam County. Sand and gravel deposits have no particular commercial importance because sufficient supplies are available closer to areas of demand.—MCM

Heizmann, J. Julien. *See* Baro, Raymond. 05988

05950 **Helmer, L. L.** A review of the basic principles and interpretive practices of capillary pressure in reservoir rocks, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. H1–H22, illus., 1968.

This paper reviews the fundamentals of capillary pressure and some of the interpretive practices involving capillary pressure in reservoir rocks. Capillary interaction between fluids and the reservoir system during accumulation and production is discussed. The work of several authors is drawn upon in an effort to provide a guide for interpretive procedure when determining initial and residual hydrocarbon saturation, permeability and relative permeability from capillary pressure data.—Author's abstract

06019 **Henderson, J. F.** (compiler). Current research in the geological sciences in Canada, 1967–68: Canada Geol. Survey Paper 68-54, 275 p., 1968.

Research projects in this compilation have been obtained from universities, federal and provincial departments of mines, and other nonindustrial institutions carrying on research in the geological sciences in Canada; in general research by mining and oil company geologists is not included. Projects are grouped under main headings that cover the different branches of the field. The author index lists after each author the numbers of the projects, listed in the bibliography, on which he is currently engaged. Some of the entries are annotated.—MCM

Herrick, S. M. *See* Georgia Geological Society. 06074

05946 **Heslop, A.** Application of porosity–water saturation relationships to log analysis in southeast Saskatchewan, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. [D]1–[D]6, illus., 1968.

Buckles' porosity–saturation relationship, although it will not solve all log interpretation problems, is nevertheless an improvement over the usual resistivity-index or saturation calculations. With its help, it is possible to delineate the transition zone for a well or pool and obtain average water saturations that are properly weighted by porosity.—*from* Author's conclusions

Hetherington, Ernest A., Jr. *See* Denison, Rodger E. 00052

Hewitt, David A. *See* Burger, H. Robert. 05922

00252 **Hewitt, Philip C.** The current and future role of departments of geology in state-supported institutions [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 27, 1969.

Heyl, Allen V. *See* Jolly, Janice L. 05981

06186 **Hibben, Frank C.** The lost Americans (revised and updated): New York, Thomas Y. Crowell Co., 187 p., illus., 1968; originally published 1946.

The story of the first humans who came to North and South America and who lived and hunted here during the Ice Age is revealed by the flint tools, fire hearths, and bones of extinct animals which these first inhabitants left behind them. Chapter headings are: beginnings of man, old world ancestors, how old is man in America?, discovery of the ancient hunters, spread of the Folsom hunters, Sandia cave man, ancient country cousins, life and times of Ice Age Americans, ancient immigrants to the new world, Bering Strait (front door to America), radioactive times, world of the ancient hunters, end of a universe, and early hunters themselves.—MCM

00253 **Higgins, E.; Kalliokoski, J.** Gravity investigation of the west and north flanks of the Pontiac massif, Quebec and Ontario [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 28, 1969.

05951 **Hilchie, D. W.; Mills, W. R.; Dennis, C. L.; Givens, W. W.** Factors affecting thermal neutron lifetime measurements, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. 11-132, table, 1968.

This paper is a critical review of the problems which confront thermal pulsed neutron (lifetime) logging today. The measurement of thermal neutron lifetime is related to porosity, rock type, water salinity, hydrocarbon saturation and type of hydrocarbon. Possible sources of error in measurement are discussed. It is concluded that although present interpretations are at best semiquantitative, general use of the tool should not rely on quantitative analysis but on the ability of the measurements to detect the presence of oil and gas.—*from* Authors' summary

05911 **Hinton, Gene.** Recluse oil field, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 73-78, illus., 1968.

Recluse field is a major stratigraphic oil accumulation in a barrier bar in the Muddy Formation. Before the discovery of Recluse, barrier-bar development in the Muddy was not known, and there is every reason to believe additional barrier bars will be found in the Muddy in the Powder River basin.—*from* Author's summary

Hintze, Lehi F. *See* Rigby, J. Keith. 06157

05957 **Hipp, Billy; Gerard, C. J.; Edwards B.** A machine for taking soil samples and placing access tubes for soil moisture and density measurements: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 886-887, illus., 1968.

The Bull hydraulic sampler mounted on a small trailer to provide greater mobility in soil sampling, can be used also for placing neutron probe access tubes, by use of a special adapter constructed with a lathe to hold the coring tube in place on the driving ram. Removal of the soil core and insertion of the access tube, by the hydraulic ram of the sampling machine, can be accomplished on clay soils in 7 to 10 min. Cleaning out the cutting tip takes less than 15 min. Several hundred cores have been taken in sandy loam and clay soils to a depth of 152 cm without difficulty; the problems of extremely dry or compact soils can be overcome by adding weight to the trailer.—GDC

00114 **Ho, Clara; Coleman, James M.** Consolidation and cementation of Recent sediments in the Atchafalaya Basin: Geol. Soc. America Bull., v. 80, no. 2, p. 183-191, illus., 1969.

Tests on core samples from a 120-ft deep borehole in the Atchafalaya Basin indicate that compressive strength increases and water content decreases with depth. These effects are caused partly by compaction and compaction-induced dewatering, but also partly by development of cementing minerals. Accumulations of iron hydrous oxides,calcium carbonates, and perhaps minor amounts of siderite, Mn oxides, and $MnCO_3$ generally increase with depth and are found in greatest abundance in zones of greatest compressive strength. Organic compounds are well preserved through the core and probably played an important role in the transformation and migration of metal cations and thus in the subsequent accumulation of cementing minerals.—ATO

06306 **Hoffman, P. F.** Stratigraphy of the lower Proterozoic (Aphebian), Great Slave Supergroup, East Arm of Great Slave Lake, District of Mackenzie: Canada Geol. Survey Paper 68-42, 93 p., illus., table, 1968.

The Great Slave Group of Stockwell (1932), unmetamorphosed Precambrian sedimentary and volcanic rocks, is expanded to a Supergroup encompassing four groups redefined with 18 new formations. The Sosan Group of four is mainly nonmarine sandstones and the Kahochella Group of four, mainly marine shales. The Pethei Group has two lithologically distinct sequences of the East Arm synclinorium—on the north limb five littoral marine limestones and dolomites, on the south limb four deep-water marine shales, graywackes and limestones, and the oldest on both limbs. The Christie Bay Group is chiefly nonmarine and marine red beds in three earlier named formations and one new. Discussed briefly are thickness, distribution, lithology, contact relations and origin of each formation, with type sections in appendix. Basal contact is unconformable on the Union Island Group, also Aphebian in age. Quartz diorite laccoliths intrude the Stark Formation and older rocks.—GDC

06340 **Hoggatt, R. E.; Hunn, J. D.; Steen, W. J.** Water resources of Delaware County, Indiana: Indiana Div. Water Bull. 37, 57 p., illus., tables, 1968.

In Delaware County, sufficient water of good quality is available with proper development in streams and aquifers. Use totals about 18.5 mgd, 37 percent of which is from ground water within 400 feet of the land surface. Wells utilizing all available zones could yield 1,000 gpm in the south-central and southeastern parts. The two principal aquifers are the upper 100 feet of Silurian dolomite which underlies the entire area at depths from 0 to about 300 feet with possible yields up to 500 gpm, and the Pleistocene aquifer of glaciofluvial sand and gravel up to 80 feet thick which underlies most of the area at depths of 0 to about 140 feet; both could yield up to 500 gpm. Sand and gravel in and near buried valleys yield water for domestic and industrial use but extent and potential are unknown.—*from* Authors' abstract

Holliday, Barry W. *See* Bowman, John R. 06158

Hollingshead, Robert D. *See* Schmidt-Collerus, Josef J. 06151

06079 **Holtz, W. G.** Soil as an engineering material: Jour. Materials, v. 4[!3], no. 4, p. 847-915, illus., tables, 1968.

The history of soils engineering is reviewed and processes of formation of soils are tabulated and discussed briefly. Properties of soils included are structural properties, permeability, gradation, and specific gravity. Soil types as grouped by the Unified Soil Classification System are tabulated; other systems are the textural and "A" types. Another table gives the engineering uses for various types of soil. The classes of soils provide a good means for delineating engineering problems; those connected with gravelly, sandy, silt and clay, and treated soils are described. Important procedures are construction control and soil sampling and testing. The need for soil engineering research is extensive.—ESL

06144 **Hood, Peter J.; Kellogg, William C.** Geophysical activity in 1967 applied to mining exploration: Geophysics, v. 33, no. 6, p. 903-910, illus., tables, 1968.

Data compiled from questionnaires sent out by the SEG Geophysical Activity Committee shows that worldwide utilization of mining geophysical methods reached a new high in 1967, with total U.S. expenditures of 32 million. This was divided as follows: ground methods, 18 million; airborne methods, 10 million; and research, 4 million. For ground methods, most money was spent on the induced-polarization technique with electromagnetic methods second. World distribution of mining activity in 1967 is tabulated.—KAF

Hoover, D. B. *See* Rummerfield, Ben F. 06142

Hopkins, David M. *See* Scholl, David W. 06122

Horn, M. K. *See* Charyula, V. 06174

00107 **Houša, Václav.** Neocomian rhyncholites from Cuba: Jour. Paleontology, v. 43, no. 1, p. 119–124, illus., table, 1969.

Two new species of rhyncholites (cephalopod beaks) are described from the Neocomian (Lower Cretaceous) Aptychus beds of western Cuba, *Planecapula alberi* and *Mesocheilus? pinarensis*. They represent the first specifically identifiable find of Mesozoic rhyncholites in America. The taxonomic position of the genus *Planecapula* Shimanskiy, 1947 is discussed.—*from* Author's abstract

06173 **Howard, James C.** Monte Carlo simulation model for piercement salt domes, *in* Computer applications in the earth sciences—Colloquium on simulation: Kansas Geol. Survey Computer Contr. 22, p. 22–34, illus., 1968.

Dome morphology and growth rate depend on the density contrast between salt and overlying sediments, buoyancy of the salt stock, geothermal gradient, and strength of overburden; these factors are depicted as functions of depth. Probability distributions are diagrammed and discussed. Expansion of the salt stock to form an overhang is a common feature in the upper part of Gulf Coast salt domes. A function representing one set of variables which can be controlled from one test run to another is shown, and is used for the 14 dome sequences illustrated. One method of testing the validity of the model is to compute the gravity anomaly attributed to the final dome in the computer generated sequence, and to compare it with the gravity picture observed for the real salt dome.—ESL

00254 **Huddle, John W.** Upper Devonian conodont zones in western New York and Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 29, 1969.

00099 **Hudson, Robert Frank.** Structural geology of the Piney Creek thrust area, Bighorn Mountains, Wyoming: Geol. Soc. America Bull., v. 80, no. 2, p. 283–295, illus., tables, geol. map, 1969.

The Piney Creek thrust fault is a major secondary flank structure that displaced Precambrian crystalline and younger sedimentary rocks 2.5 miles eastward at the east side of the Bighorn Mountains. Of eight joint sets in Precambrian rocks, three seem to have developed during Laramide deformation, and two in Precambrian time. Precambrian structures seem to have controlled the trend of the tear fault at the south end of the Piney Creek thrust, but do not seem to have controlled the trend of the Pine Creek thrust or of the Bighorn Mountains. Prominent conjugate joints in Paleozoic sedimentary rocks indicate a maximum stress direction of N. 54° E., which suggests compression in that direction early during Laramide deformation prior to dominant uplift later during Laramide deformation.—WHN

Hunn, J. D. *See* Hoggatt, R. E. 06340

Idriss, Izzat M. *See* Seed, H. Bolton. 00163

Ikawa, Haruyoshi. *See* Sherman, G. Donald. 00091

06312 **Irish, E. J. W.; Havard, C. J.** The Whitemud and Battle Formations ("Kneehills Tuff zone"), a stratigraphic marker: Canada Geol. Survey Paper 67-63, 51 p., illus., tables, 1968.

In the uppermost Cretaceous of southern Alberta plains, the Whitemud Formation's clay and clayey sands weather white, and the overlying Battle Formation's dark clay and shale, purple-gray. In the Red Deer-Bow Rivers region this zone divides the Edmonton Group into two parts; in the Oldman River region it separates the St. Mary River and Willow Creek Formations. The Battle Formation, now mainly decomposed volcanic ash, was wind-blown into extensive shallow water; in its upper part the distinctive Kneehills Tuff was silicified prior to appreciable chemical alteration. The predominant clay mineral in the Whitemud of southeastern Alberta is kaolin; to the west it is montmorillonite. The Kneehills Tuff zone can be traced widely in the subsurface by electric logs. In correlating the Upper Cretaceous nonmarine it is the datum for three cross-sections; heavy minerals tables, and isopach and structure contour maps are included also.—GDC

00070 **Irving, E.; Robertson, W. A.** Test for polar wandering and some possible implications: Jour. Geophys. Research, v. 74, no. 4, p. 1026-1036, illus., tables, 1969.

There are two magnetic methods of estimating drift of the lithosphere: the polar method and the reversal method. Within the same segment of lithosphere these estimates are not in agreement as they should be if polar wandering had not occurred. The most likely causes of their disagreement are considered to be polar wandering and movement of the ridges. Changes of ridge pattern alone would lead to unlikely tectonic situations. The rapid apparent polar movements observed in the upper Carboniferous and in the middle Tertiary of Australia are therefore considered to be evidence of rapid episodic polar wandering (about 20 cm per yr) superimposed on a background of comparatively slow crustal drift (1-3 cm per yr) whose pattern periodically changes. On this basis a general scheme relating diastrophism and geomagnetic variations is proposed.—*from* Authors' abstract

05891 **Irving, E.; Robertson, W. A.** The distribution of continental crust and its relation to ice ages, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 168-177, illus., discussion, 1968.

Paleomagnetic data have provided evidence for polar wandering at the end of the Paleozoic. On the premise that development of circumpolar glaciation is more probable in areas in which the pole is located in a large landmass or in a small epicontinental sea rather than in the open ocean, a south pole position is determined on the basis of distribution of glacial deposits. The close correspondence with the paleomagnetically determined pole position suggests that the southern continents were close together in the late Paleozoic.—MS

Ishihara, Shunso. *See* Shibata, Ken. 06178

Iwasaki, I. *See* Vifian, A. 06351

Jackson, M. L. *See* Rex, R. W. 00140

Jackson, M. L. *See* Wildman, W. E. 05960

Jackson, M. L. *See* Dolcater, D. L. 05961

00125 **Jacoby, Charles H.** Correlation, faulting, and metamorphism of Michigan and Appalachian basin salt: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 136-154, illus., 1969.

Correlation of Salina Formation (Upper Silurian) salt units and subunits from Michigan to the Appalachian basin is facilitated by use of gamma-ray logs. Examples of different structural features in bedded salt sections in mining areas are analyzed from borings, well logs, and mine exposures. At Detroit, Mich., truncation of salt beds, collapse breccias, areas of subsidence, and channel-fills of

secondary salt are interpreted to represent dissolution of salt beds by meteoric waters. Faulting is the major structural disturbance of Retsof and Watkins Glen, N.Y., and at Cleveland, Ohio. At Ludlowville, N.Y., major folding and minor faulting, with salt flowage and recrystallization, are probably due to elevated geothermal temperatures and stresses accompanying growth of the Portland Point anticline.—EGS

Jaffe, Elizabeth B. *See* Jaffe, Howard W. 05978

05978 **Jaffe, Howard W.; Jaffe, Elizabeth B.** Memorial of Albert Williams Postel (Jan. 5, 1909–May 11, 1966): Am. Mineralogist, v. 53, nos. 3–4, p. 586–590, portrait, 1968.

06104 **James, Harold L.** Mineral resource potential of the deep oceans, *in* Mineral resources of the world ocean—Symposium, Newport, R.I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, p. 39–44, table, 1968.

Mineral resource potential is considered for each principal subdivision of the deep ocean. Potential is small per unit area compared with that of continents, because of fundamental differences such as absence of thick sialic crust and of exposed ore-bearing Precambrian and Paleozoic strata. Manganese nodules are thinly distributed over vast areas of the ocean basins, but at present must be classed as a submarginal resource; exploitation should be limited to the areas of relatively shallow water in which the nodules contain unusually large amounts of Ni, Co, and Cu. Petroleum possibilities theoretically are moderately good in thick sediments of the continental rise and small ocean basins (e.g. Gulf of Mexico), less good in island arcs and trenches. Mineral potential of the basaltic midoceanic ridge is very low, with remote possibilities of metal deposits.—VMJ

Jantzen, R. E. *See* Finks, R. M. 00272

06343 **Jeffries, F.; Reichl, F. E.** Imperial Oil using wireline logs for computer evaluation of oil reserves: Canadian Petroleum, v. 9, no. 12, p. 32–37, illus., 1968.

Wireline logs show the variation of physical parameters with depth. To reconcile these measurements with other sources of information, these properties must be transformed into meaningful estimates of more easily understood analyses that can be used as data supplementary to traditional core analyses and drill-stem-test results; such an approach is illustrated by the Swan Hills oil fields, Alberta. Linear programming can also be used to examine simultaneously all information from an individual well to obtain the most probable rock composition; the Rainbow Lake area of northern Alberta is used as an example.—ESL

00255 **Jeffs, Donald N.; Viirland, Jaak.** Special cases of water supply interference caused by urban development near Toronto, Ontario, Canada [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 29–30, 1969.

00256 **Johnsen, John H.; Waines, Russell H.** Cayugan and early Helderbergian stratigraphy near Accord, New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 30, 1969.

Johnsen, S. J. *See* Dansgaard, W. 00059

Johnson, Gerald H. *See* Bowman, John R. 06158

Johnson, Gerald H. *See* Luebke, William C. 06159

00128 **Johnson, J. G.; Lane, N. Gary.** Two new Devonian crinoids from central Nevada: Jour. Paleontology, v. 43, no. 1, p. 69–73, illus., table, 1969.

Gennaeocrinus maxwelli n.sp. [Roberts Mts., Eureka County] is the first member of the family Periechocrinitidae to be found in the Lower Devonian of North America. Periechocrinitids were previously known only from Middle Devonian rocks in eastern North America. *Gasterocoma? bicaula* n.sp. [Lower to Middle

Devonian,Lone Mtn.] is of interest because it is the source of at least some 'two-hole' crinoid ossicles and because they can be shown to be cirral, rather than columnal, ossicles.—*from* Authors' abstract

Johnson, J. G. *See* Boucot, A. J. 00208

Johnson, J. G. *See* Boucot, Arthur J. 05894

06313 **Johnson, LeRoy, Jr.** Item seriation as an aid for elementary scale and cluster analysis: Oregon Univ. Mus. Nat. History Bull. 15, 46 p., illus., tables, 1968.

Seriation is used for scaling items according to their similarities, and as a preliminary analytic step in grouping items into homogeneous units. This discussion treats seriation from the standpoints of its basic nature, its history and treatment in literature, its problems for computer processing, and its proper use, particularly in conjunction with other aids, in generating overviews for bodies of numerical data. Two previously published data sets are used as examples; the first is of 11 late Tertiary vertebrate collections, mostly from eastern Oregon; the second, is of 26 Paleolithic artifact collections from southeastern France.—ESL

05981 **Jolly, Janice L.; Heyl, Allen V.** Mercury and other trace elements in sphalerite and wallrocks from central Kentucky, Tennessee, and Appalachian zinc districts: U.S. Geol. Survey Bull. 1252-F, p. F1–F29, illus., tables, 1968.

Sphalerite from central Tennessee, central Kentucky, and other mineral deposits in the central and eastern United States contains anomalous quantities of mercury (100 to 300,000 ppb) as an integral part. Epigenetic sphalerites from central Kentucky and central Tennessee districts contain notable amounts of cadmium, germanium, gallium, barium, and strontium, but diagenetic sphalerites are lean in these elements. Sphalerites from the Appalachian Valley zinc districts are relatively lean in mercury, germanium, and gallium. Those from higher temperature deposits in Maine are not only enriched in iron and manganese, as expected, but also in silver. Preliminary results show that several minerals, soils, and wallrocks above and near orebodies also contain anomalous mercury which can be used in prospecting for deposits.—JLJ

05916 **Jones, Bob.** The use of Rw and Sh log-derived values in oil and gas exploration programs, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 101–105, illus., 1968.

Maps derived from log data, such as Rw (formation water resistivity) and Sh (hydrocarbon shows) hold considerable promise because they work with fluid variables within a formation rather than simply the physical position derived from formation tops or seismic reflections. Their nearest counterparts are, using physical evidence, regional stratigraphic analyses and isopach maps of porosity and permeability. Errors can be avoided by use of improved porosity estimates (density or sonic logs), identification of disturbing lithologic conditions (gamma-ray logs), and by improved true resistivity determination from filtrate invasion knowledge (multiple-focussed resistivity measurements). Examples are taken from the Powder River basin in Wyoming.—HRC

05984 **Jones, Charles L.; Madsen, Beth M.** Evaporite geology of Fifth ore zone, Carlsbad district, southeastern New Mexico: U.S. Geol. Survey Bull. 1252-B, p. B1–B21, illus., geol. map, 1968.

Analysis of cores, samples, and geophysical well logs shows that the Fifth ore zone of the Carlsbad district is a laterally persistent unit of halite, argillaceous halite, and claystone containing a variety of potassic minerals and rocks. The potash is in massive and disseminated deposits, in which preservation of bedding and other stratigraphic details is virtually complete. The two types of deposits are characterized by similar suites of potassic bittern minerals, but only the massive deposits contain the langbeinitic and sylvitic saline rocks of economic importance. The main deposit thickens and thins along its length; it varies markedly in lithology

from place to place; and in form it is a labyrinthic complex, not a simple seam or blanketlike deposit in a layered sequence of evaporitic rocks.—Authors' abstract

Jones, Clive R. *See* Yochelson, Ellis L. 05863

Jordan, Jane C. *See* Schiffman, Robert L. 00157

00257 **Jordan, William M.** Observational error in cross-bed orientation studies [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 31, 1969.

Joyner, B. F. *See* Sutcliffe, H., Jr. 06078

06034 **Judd, James B.; Smith, William C.** Environmental significance of iron-stained quartz on the local continental shelf [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4, p. 439, 1968.

Kalliokoski, J. *See* Higgins, E. 00253

00258 **Kane, Martin F.** Gravity anomalies over igneous rocks in the New England Appalachians [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 31, 1969.

00216 **Kantrowitz, I. H.; Weist, W. G., Jr.** Geologic factors affecting urbanization in New York State [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 32, 1969.

Kaplan, I. R. *See* Ben-Yaakov, S. 06049

Kassiff, G. *See* Baker, R. 06059

06139 **Kattelman, Donald F.** Geology of the Desert Mountain intrusives, Juab County, Utah: Brigham Young Univ. Geology Studies, v. 15, pt. 1, p. 85–107, illus., tables, geol. map, 1968.

Isolated peaks rising above Pleistocene alluvium in east central Juab County are dominated by two genetically related intrusive igneous bodies of contrasting mineralogy. A dark granodiorite is intruded by a leucogranite, adjacent to which is a rhyolitic porphyry containing inclusions and roof pendants of Precambrian(?) metasediments. Adamellite on the margins of the leucogranite and granodiorite, and as inclusions in the leucogranite, and alaskite porphyry, in isolated outcrops adjacent to the leucogranite and rhyolite porphyry, are present. Aplite, pegmatite and lamprophyre dikes cut the leucogranite. Post-magmatic hydrothermal mineral deposits of chrysocolla, malachite, chalcopyrite, and fluorite have little economic significance. The mineral composition of the several intrusive differentiates supports field observations in determining genetic relationship.—*from* Author's abstract

00218 **Kauffman, Marvin E.; Campbell, Lyle.** Revised interpretation of the Cambrian Kinzers Formation in southeastern Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 32–33, 1969.

00237 **Kay, Marshall.** Stratigraphy of Middle Ordovician limestones in New York and Ontario [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 33, 1969.

Kay, Marshall. *See* Dewey, John. 05890

Keefer, W. R. *See* Love, J. D. 00130

00055 **Keeley, Jack W.; Scalf, Marion R.** Aquifer storage determination by radiotracer techniques: Ground Water, v. 7, no. 1, p. 17–22, illus., 1969.

A new method of determining aquifer storage coefficients has been developed for use in operations involving ground-water recharge through wells. This work evolved from a research project dealing with the fate of DDT and nitrate in the Ogallala aquifer in the High Plains of Texas. A tritium tracer was used to determine detention

time of recharge water passing through a saturated volume of the aquifer. Tracer behavior was formulated mathematically and verified by model simulation. The formulations provide a graphical solution for detention time from which storage coefficient may be calculated. The method will have immediate value in establishing storage coefficients of aquifers, such as the Ogallala, where plans for importation and distribution of supplemental water involve utilization of underground storage, and promises to produce more reliable storage values than have been obtained from pumping tests.—*from* Authors' abstract

06115 **Keiffer, Elisabeth.** (editor). Mineral resources of the world ocean—Symposium, Newport, R.I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, 108 p., illus., tables, 1968.

This symposium, the first of its kind, was cosponsored by the U.S. Geological Survey, the University of Rhode Island, and the U.S. Navy. It brought together representatives from science, industry, government, and the military to discuss problems and possibilities in recovering the mineral resources of the oceans. Four subject areas were covered: ocean–geologic time, mineral resources, new technology and engineering, and public policy questions. Of the 15 papers published in the proceedings (lacks the paper by J. Ewing, "The geology of the deep ocean"), those pertinent to North American geology are cited separately.—VMJ

06326 **Keller, W. D.** Flint clay and a flint-clay facies: Carolina Univ. Acta, Geologica 1968, nos. 1–2, p. 151–174, illus., tables, 1968.

The definition of flint clay implies ceramic properties. First recognized in U.S.A., flint clay is probably more abundant than its world occurrences reported to date. It is found mainly in Carboniferous or Cretaceous rocks, invariably associated with plant- or coal-measures, and deposited in low paludal basins in either clastic silicate rocks or in karstic carbonates. It is inferred that parent illitic and/or kaolinitic clay colloids were transported into the swamps, and altered in situ to produce homogeneous kaolinitic clay with interlocking crystallinity, some further dessicated to diaspore and boehmite. Interpreted as an intermediate member of a flint-clay facies, the claystone sequence ranges from high-alumina minerals in its top part through flint clay to illite-kaolinite plastic clay and thence to marine illitic shale, all stratigraphically equivalent. The geochemical reactions are depotassification of parent clay and desilication.—GDC

05975 **Keller, Walter D.; Muilenburg, Garrett A.; Ellison, Samuel P., Jr.** Memorial to Oliver Rudolph Grawe (Nov. 26, 1901–March 22, 1965): Am. Mineralogist, v. 53, nos. 3–4, p. 555–560, portrait, 1968.

Kelling, Gilbert. *See* Stanley, Daniel K. 00202

Kellogg, William C. *See* Hood, Peter J. 06144

Kenny, George S. *See* Denison, Rodger E. 00052

05873 **Kernaghan, James S.; Garske, David H.** Marble and tungsten in the southwestern portion of the Harney Peak "dome", Custer County, South Dakota, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 173–176, illus., tables, 1968.

The area is underlain by granite, gneiss, skarn, marble, amphibolite, and quartzite; all are described petrographically. The tungsten mineralization, as scheelite, generally occurs in the marble and skarn but is also in the amphibolite. In the skarn, the scheelite is scattered along zones parallel to the compositional layering, usually near the contacts with granite. The marble contains even more scheelite, possibly in commercial amounts. In one quarry, mineralization appears to parallel compositional bands in both the amphibolite and marble. The scheelite could be metamorphic in origin or more probably metasomatic. Marble was quarried for a brief time as a building stone and still has possibilities.—HRC

06311 **Kerr, J. William.** Stratigraphy of central and eastern Ellesmere Island, Arctic Canada—Pt. 2, Ordovician: Canada Geol. Survey Paper 67–27, pt. 2, 92 p., illus., tables, 1968.

In the Franklinian miogeosyncline and adjacent Central Stable region of Ellesmere Island, the thick Lower Ordovician Copes Bay Formation comprises thin-bedded limestones with thinner shelf equivalents in the Bache Peninsula arch; the overlying Baumann Formation is mainly a gypsum–anhydrite lens. The Lower to early Middle Ordovician Eleanor River Formation is bluff-forming limestone. The Middle and Upper Ordovician Cornwallis Group includes three thinner formations: the Bay Fiord limestone, siltstone, and evaporites under shaly siltstone and shale; the Thumb Mountain bluff-forming limestone; the Irene Bay argillaceous limestone, with large fossils of Arctic fauna. Shallow water deposition is indicated; maxima in each unit trend along the miogeosyncline. Six small isopach maps, and correlation tables and sections are included.—GDC

06119 **Kester, Dana R.; Pytkowicz, Ricardo M.** Magnesium sulfate association at 25C in synthetic seawater: Limnology and Oceanography, v. 13, no. 4, p. 670–674, tables, 1968.

The formation of magnesium sulfate ion pairs, $Mg^{2+} + SO_4^{2-} \leftrightarrows MgSO_4^0$, in an aqueous $NaCl–MgCl_2–Na_2SO_4$ solution was characterized by a stoichiometric association constant for $MgSO_4$ equal to the ratio of $[MgSO_4^0]$ to $[Mg^{2+}][SO_4^{2-}]$, the brackets denoting molalities. A value of 10.2 for this constant, obtained at 24°C and at an ionic strength of 0.670 by a potentiometric procedure, was used to make a preliminary estimate of the sulfate speciation in sea water. Percentages of unassociated ion concentrations of magnesium, sodium, and sulfate, and percentage of the total sulfate present as each species are compared with the estimates of Garrels and Thompson (1962) and other workers.—*from* Authors' abstract

05964 **Khalifa, E. M.; Buol, S. W.** Studies of clay skins in a Cecil (Typic Hapludult) soil—[Pt.] 1, Composition and genesis: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 857–861, illus., tables, 1968.

Continuous clay skins are found on ped faces, in pores, and around root channels in the B22t horizon of Cecil soils in North Carolina. Thicker, discontinuous clay skins are also observed along vertical pores in the C1 horizon. Compared to the whole peds from the B22t horizon the clay skin contains more clay, fine clay ($<0.2\mu$), total iron, free iron, Al_2O_3, K_2O, P_2O_5, and total nitrogen; less silica and gibbsite than the whole soil peds. The fine clay fractions ($<0.2\mu$) of the A2 horizon and the clay skins of the B22t horizon are similar, both being finely divided and poorly crystalline compared to the fine clay from the whole peds of the B22t horizon and the clay skins in the C1 horizon.—Authors' abstract

00053 **Kimoto, Shizuo; Russ, John C.** The characteristics and applications of the scanning microscope: Materials Research and Standards, v. 9, no. 1, p. 8–16, illus., 1969.

The scanning electron microscope provides information on the topography, composition, and electrical behavior of a variety of solid samples, and density information on thin sections. In presently available instruments, the resolution of about 200 A, combined with great depth of field, is favorably comparable [with] the replica techniques, and the scanning electron microscope avoids the problems of specimen damage or the introduction of artifacts. In addition, it permits the examination of many samples that cannot be replicated, and provides a broader range of information. The scanning electron microscope has found application in diverse fields of study, including biology, materials science, semiconductor technology and many others.—Authors' abstract

06066 **King, Norman J.** Restoration of gullied valley floors in arid and semiarid regions, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 12, Engineering geology in country planning: Prague, Academia, p. 187–195, illus., 1968.

Not all gullied valley floors are equally amenable to treatment. Narrow gullies with severely eroding banks should be allowed to widen naturally to the extent that they will ultimately be amenable to treatment. Treatment practices aimed at controlling runoff should be designed and distributed across a basin so as to achieve the most uniform decrease in discharge possible throughout the drainage net. So far as practical, treatments aimed at reducing discharge should withhold as much water and as little sediment as possible from the gully net. This can be accomplished by applying treatment practices mainly to noneroding areas.—KAF 0603

00238 **Kirchgasser, William Thomas.** Stratigraphic relations within the Frasnian Cashaqua Shale Member (Sonyea Formatign) of New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 33–34, 1969.

Kirkwood, Samuel. *See* Swain, F. M. 06304

00129 **Klapper, Gilbert.** Lower Devonian conodont sequence, Royal Creek, Yukon Territory, and Devon Island, Canada, *with a section on* Devon Island stratigraphy by A. R. Ormiston: Jour. Paleontology, v. 43, no. 1, p. 1–27, illus., table, 1969.

Five conodont faunas from Royal Creek, Yukon Territory, ranging in age from Gedinnian to Emsian, were found in association with brachiopod faunal units (Lenz, 1967). This conodont sequence is similar to the Lower Devonian conodont sequence in Eureka County, Nev. The succession of species of *Polygnathus* in the *Eureka-spirifer pinyonensis* Zone shows that the upper part of that zone is equivalent to the Blue Fiord Formation in Devon Island and that the youngest conodont fauna at Royal Creek, with *Polygnathus lenzi* n.sp., is older than the Blue Fiord fauna, with *P. foveolatus*. Eight new species and subspecies of *Icriodus, Polygnathus, Pelekysgnathus, and Spathognathodus* are described.—JWH 0015

05938 **Klein, George deVries.** Sedimentology of Triassic rocks in the lower Connecticut Valley, Trip C–1 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol.Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 19 p., paged separately, illus., table, 1968.

There are nine stops on this trip, each demonstrating some different aspect of the sedimentation of the Triassic Newark Group. Four environmentally controlled sedimentary facies—the proximal alluvial fan, the distal alluvial fan, the floodplain, and the mixed facies—are outlined and discussed at the various stops. The mixed facies contains cycles attributed to a combination of continued fault-trough subsidence and variation in the rate of sedimentation; possibly climatic variations caused the latter.—HRC 0023 0605

Kleinkopf, M. Dean. *See* Harrison, Jack E. 00123

Kline, Charles. *See* Cooley, Tillman. 06004

05955 **Knutson, G. C.** Correlation and analysis of well-bore information by digital computer, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. [N]1–[N]10, illus., 1968.

Effective utilization of well-bore information requires that all available information can be incorporated in the analysis. The diversity of problems and available data requires complete flexibility as to the computations performed. Effective display of the results is necessary for efficient application. Reliability of the results still depends on significance of data and the interpretation procedures employed. The computer program only serves as a tool to permit highly detailed analyses to be undertaken.—from Author's conclusions 0024

06333 **Kobayashi, Kazuo.** Paleomagnetic determination of the intensity of the geomagnetic field in the Precambrian period: Physics Earth and Planetary Interiors, v. 1, no. 6, p. 387–395, illus., tables, 1968. 0024 0617

Experimental determinations were made of the geomagnetic field intensity in the Precambrian period by investigations of magnetic properties as well as microscopic

and crystallographic feature of samples of amphibolite from Matachewan, Canada; quartz-bearing pyroxene gabbro from Abitibi, Canada; tholeiitic gabbro from Muskox, Canada; and pyroxene gabbro from Skrainka, Missouri. Results indicate that the stepwise heating method is a very reliable technique if additional tests are made for the limit of feasibility,and that various types of igneous rocks are suitable for intensity determination. The intensity of the Precambrian field for the period between 1150 and 2485 m.y. was nearly equal to that at present.—VSN

06030 **Kohut, Joseph J.; Sweet, Walter C.** The American Upper Ordovician standard—[Pt.] 10, Upper Maysville and Richmond conodonts from the Cincinnati region of Ohio, Indiana and Kentucky: Jour. Paleontology, v. 42, no. 6, p. 1456–1477, illus., tables, 1968.

About 56,000 conodont elements are referred to 25 species and 16 genera. One new species, *Rhipidognathus rowlandensis*, is described. The conodonts came from 16 sections in rocks of Late Maysville and Richmond age in the Cincinnati area. Three faunas are recognized. A northern fauna dominated by *Phragmodus undatus* and *Plectodina furcata* and a southern fauna distinguished by species of *Plectodina*, *Zygognathus*, and *Rhipidognathus* were present throughout the late Maysville and Richmond time. In late Richmond time a third fauna characterized by *Belodina* and *Panderodus* invaded from the northwest.—JWH

00155 **Komornik, Amos; David, David.** Prediction of swelling pressure of clays: Am. Soc. Civil Engineers Proc., v. 95, paper 6358, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 209–225, illus., table, 1969.

The mathematical formulation of the swelling pressure of pure clay was verified experimentally by Bolt (1956). However, in naturally occurring clays a statistical model is preferable, with chemico-physical properties such as specific surface area or particle spacing represented by simple indicative parameters. This study was carried out with basic theoretical concepts in mind. An attempt was made to relate the parameters. Good statistical correlation was found to exist between swelling pressure and a combined function of initial dry density, moisture content, and liquid limit. Bolt's mathematical formulation was used to derive an expression relating the compression index to the liquid limit.—Authors' abstract

00239 **Kraft, John C.** Pre-Holocene paleogeography and paleogeology in the Delaware coastal area [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 34, 1969.

06053 **Kramer, James R.** Mineral-water equilibria in silicate weathering, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 6, Geochemistry: Prague, Academia, p. 149–160, illus., tables, 1968.

Equilibria of common rock-forming silicates are used to deduce concentrations of dissolved species in lakes and streams, ground water, and water extracted from sediment. Water from lakes and streams has Na^+, K^+, H_4SiO_4, and pH concentration values very close to equilibrium of (Na,K) feldspar-mica in igneous and metamorphic rock terranes. In sedimentary terranes concentrations approach values predicted by kaolinite-gibbsite and (Na,K) feldspar-kaolinite equilibria. Water extracted from sediment is analogous to the above conclusions except that this water appears to be saturated with respect to amorphous silica. These conclusions represent equilibrium chemical quantification of the chemical weathering sequence: feldspar, mica, kaolinite, gibbsite. Therefore, reliable thermodynamic data for silicate minerals allow quantitative deduction of weathering.—Author's abstract

00240 **Kreidler, W. Lynn.** Evaluation of suitability of the Potsdam and Theresa Formations for underground disposal of industrial liquid waste [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 35, 1969.

00241 **Krogh, T. E.; Davis, G. L.** Isotopic ages along the Grenville front [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 35, 1969.

06171 **Krumbein, W. C.** Computer simulation of transgressive and regressive deposits with a discrete-state, continuous-time Markov model, *in* Computer applications in

the earth sciences—Colloquium on simulation: Kansas Geol. Survey Computer Contr. 22, p. 11–18, illus., tables, 1968.

The first-order, discrete-time, discrete-state Markov chain, with a one-step memory, has limitations in stratigraphic simulation, relating in part to lack of correlation in terms of marker beds, from one simulation to another. This limitation can be reduced by setting up a Markov model in which states are defined by position of the strand during a transgression–regression cycle; in this way lateral continuity of beds is preserved. The simulation model presented is a continuous-time, discrete-state model based on transition rates instead of transition probabilities; it generates several equally spaced borehole or outcrop sections that show the kinds of deposits formed during each stage of the cycle. The transgressive–regressive littoral sand can be traced easily through the simulations. Steps involved in transformation of a simple deterministic model to its stochastic counterpart are described.—*from* Author's abstract

00103 **Kuenzi, W. David; Richard, Benjamin H.** Middle Tertiary unconformity, North Boulder and Jefferson basins, southwestern Montana: Geol. Soc. America Bull., v. 80, no. 2, p. 315–320, illus., 1969.

The middle Tertiary unconformity, mappable throughout the Townsend, Clarkston, and Three Forks basins, can be mapped also throughout the North Boulder and Jefferson basins. In the North Boulder basin, as in the Three Forks basin, the unconformity is erosional; in the other three basins it may be angular as well. The unconformity separates strata as young as middle Oligocene from strata as old as upper Miocene. The topography in the North Boulder and Jefferson basins at the end of the middle Tertiary erosional episode was apparently similar to the present topography, but drainage was probably to the southwest. Then, as now, one or more broad benches rose gently toward the mountain fronts, and at least part of one bench rose from a scarp bordering the floodplain of the ancestral Jefferson River.—Authors' abstract

00242 **Kulander, Byron.** A structural analysis of Browns Mountain anticline in West Virginia [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 36, 1969.

05966 **Kunze, R. J.; Uehara, G.; Graham, K.** Factors important in the calculation of hydraulic conductivity: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 760–765, illus., table, 1968.

Calculation of hydraulic conductivity by a modified Millington–Quirk method with a matching factor gave values close to experimentally measured values. Factors that affect calculated values and improve computational results were investigated. Calculated conductivities decreased with increasing number of pressure classes at low moisture contents; for all soils tested they were less than experimental values at terminal point of moisture characteristic. This discrepancy was partially corrected by a small change in the method's equation, by extending moisture characteristics to higher suction values, and by reducing number of pressure classes to about 10. The matching factor, ratio of measured over calculated saturated conductivity, was found necessary to obtain best fit of calculated and measured data. All computations were by computer.—*from* Authors' abstract

06111 **Kupfer, D. H.; Hamil, M. M.; Carpenter, G. F.** The Rocky Mountain frontal fault, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 3, Orogenic belts: Prague, Academia, p. 313–327, illus., 1968.

Uplift of the Front Range of Colorado along a series of aligned faults establishes a sharp boundary between the orogenically deformed western half of the United States and the craton. Typically the main trace is straight, narrow, dips 55°–80° west, and separates up-dragged sediments from granite complex. Precambrian dikes demonstrate that movement and trends were established in Precambrian. Interbedded slump breccias in Ordovician and Mississippian carbonate formations, localized along the strike of the fault, establish two periods of hitherto unrecognized submarine scarp formation that triggered local slumping. The major movement, late Paleozoic, is recognized on both sides of the Front Range from structural and

stratigraphic evidence, notably 1400 m of arkosic detritus. Steep-dipping Mesozoic strata indicate early Tertiary movement; major topographic relief is late Tertiary.—*from* Authors' abstract

00056 **Kuroda, P. K.** Plutonium-244 in the early solar system [reply to discussion by J. H. Reynolds (1968) of paper by D. D. Sabu and P. K. Kuroda (1967)]: Nature, v. 221, no. 5182, p. 726–729, illus., tables, 1969.

In reply to Reynolds' claim (ibid., v. 218, no. 5146, p. 1024–1028, 1968) that Sabu and Kuroda's recent paper (ibid., v. 216, no. 5114, p. 442–446, 1967) contained many computational errors and that there is no concordancy of the sort displayed in a given figure between Pu/Xe and I/Xe methods of dating meteorites, Kuroda points out recent studies on abundances of Pu-244 and I-129 in the early solar system that support the continuous galactic nucleosynthesis theory. The agreement between the two 'nuclear clocks' is excellent.—DBV

06166 **Kurtén, Björn.** The age of the dinosaurs: New York and Toronto, McGraw-Hill Book Co. (World Univ. Library), 255 p., illus., tables, 1968.

The book is divided into eight chapters: theories and discoveries, Earth history before dinosaurs, the dinosaurs, other terrestrial vertebrates, vertebrates of the sea, flora and invertebrates, geography of the Jurassic and Cretaceous, and after the dinosaurs. A classification of Vertebrata of the Jurassic and Cretaceous is appended.—ESL

Ladd, Harry S. *See* Gross, M. Grant. 00092

Lane, N. Gary. *See* Johnson, J. G. 00128

Langenheim, Virginia A. *See* Willman, H. B. 06015

Lanphere, Marvin A. *See* Wahrhaftig, Clyde. 00169

00138 **Larson, Roger L.; Spiess, Fred N.** East Pacific Rise crest—A near-bottom geophysical profile: Science, v. 163, no. 3862, p. 68–71, illus., 1969.

A deep-towed magnetometer profile across the East Pacific Rise crest shows many anomalies with 1000-gamma amplitudes and 500-m wavelengths and has larger amplitude changes corresponding to magnetic field reversals. This profile across contacts between normal and reversely magnetized crustal blocks is interpreted to place an upper limit of 4700 years on time required for field reversals and an upper limit of 280 m on width of the intrusion center at the crest. This intrusion center may occasionally shift several km laterally with respect to the rise axis. Magnetometer records are compatible with the hypothesis that the magnetic field has undergone many fluctuations of short period and small intensity in the past 2 m.y. Sediment accumulation increases from less than 2 m at the rise crest axis to about 20 m at the western and 10 m at the eastern end of the profile; this increase appears to be the result of ocean-floor spreading.—*from* Authors' abstract

06302 **Laurence, Robert A.** Ore deposits of the Southern Appalachians, *in* Ore deposits of the United States, 1933–1967 (Graton-Sales Volume), V. 1: New York, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 155–168, illus., 1968.

Ore deposits in the Southern Appalachians are (1) sedimentary or syngenetic, (2) epigenetic, and (3) residual. In general, high temperature and pressure deposits are in the Blue Ridge and Piedmont and the others, including sedimentary ores, are in the Valley and Ridge and Appalachian plateau. Residual deposits are present everywhere. Recognition of several periods of intrusion and metamorphism in the Appalachians has changed former concepts which held that most of the mineralization was of late Paleozoic age in a zonal pattern including all of the provinces. Many deposits are probably of early or mid-Paleozoic age. Similarly, recent studies in geomorphology indicate that the formation of residual deposits is a continuous process and not related to specific cycles of peneplanation.—*from* Author's abstract

06168 **Lawrence, Barbara.** Antiquity of large dogs in North America: Tebiwa, v. 11, no. 2, p. 43–49, illus., tables, 1968.

Cranial and jaw fragments of a larger dog, equally old, have been identified from the Jaguar Cave, Birch Creek valley, Idaho, site, from which a small dog with a C–14 date of 8,400 B.C. has been described. The material is described, illustrated, and compared with related specimens.—ESL

06320 **Leake, Bernard E.** A catalog of analyzed calciferous and subcalciferous amphiboles together with their nomenclature and associated minerals: Geol. Soc. America Spec. Paper 98, 210 p., illus., tables, 1968.

This paper presents 1217 analyses of amphibole having six percent or more CaO; physical constants are given for 1106, as well as half-unit cell contents of each, reference source, locality, mineral assemblage in which amphibole occurs, whether any coexisting mineral has been analyzed, indication of quality of analysis, and a name which conveys the composition of each amphibole. Ca 1.50 and above in the half-unit cell defines calciferous amphiboles, Ca 1.00–1.50 the subcalciferous. A rational nomenclature is proposed based on the well-known end members tremolite, richterite, tschermakite, edenite, pargasite, and hastingsite. Three important variables define the main name, and prefixes indicate unusual features. One-third of the analyses appear to be superior, one-third moderate, and one-third inferior; of recent analyses about half are superior. Frequency-distribution polygons show ranges of compositions and coexistence.—GDC

06020 **Leaming, S. F.** Sand and gravel in the Strait of Georgia area: Canada Geol. Survey Paper 66–60, 149 p., illus., 1968.

Sand and gravel deposits in the Strait of Georgia area are units of Pleistocene and Recent unconsolidated deposits. The most important formations are those associated with the Fraser glaciation and include Capilano sediments, Abbotsford, Huntingdon and Mary Hill outwash; of less importance are the postglacial Salish sediments, interglacial Quadra sediments, and older drift. Most gravel deposits tend to be sandy and are classified as sandy gravel. The areal descriptions of the geology and distribution of sand and gravel are for the Fraser Lowland, Georgia Lowlands, Vancouver Island, and Strait of Georgia Islands.—MCM

Learned, R. E. *See* McCarthy, J. H., Jr. 00166

Lee, G. Fred. *See* Delfino, Joseoh J. 06345

00162 **Lee, Kenneth L.; Shen, C. K.** Horizontal movements related to subsidence: Am. Soc. Civil Engineers Proc., v. 95, paper 6336, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 139–166, illus., 1969.

A review of documented field examples shows that horizontal surface movements often accompany vertical subsidence and appear to follow a well defined pattern which is the same for horizontal movements associated with subsidence due to mining; gas, oil or water pumping; or to deep consolidation under a heavy fill load such as at an industrial development or an earth dam. A semi-empirical and simple equation appears to predict the nature and magnitude of horizontal movements correctly, provided the vertical subsidence profile is known. An application of the finite-element method of analysis in computing both vertical and horizontal movement is also illustrated. Results of the two methods are compared to data obtained from a laboratory model, a hypothetical earth dam on a compressible foundation, and an actual rockfill dam which settled as the water level rose.—*from* Authors' abstract

06003 **Lemmon, Robert E.** Chemical trends in the Salisbury granitic pluton, North Carolina [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4, p. 437, 1968.

Leopold, Estella B. *See* Wahrhaftig, Clyde. 00169

05920 **Levene, Harold.** Economics of coal as an energy source in the Black Hills, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th

Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 143–146, tables, 1968.

Even though coal reserves in the Black Hills region are insufficient for a large commercial venture, in the three-state area near the Black Hills, ample reserves exist for very large development. Reserves are sufficient to justify a network of long-distance power lines from some major coal-fired power plants. The strongest possibility, however, is the conversion of coal to liquid fuels and transportation of the product by pipeline to such markets as Chicago.—*from* Author's conclusions

Levinson, A. A. *See* Tettenhorst, Rodney. 05967

Leyden, R. *See* Ewing, J. 00126

00082 **Libby, Fred.** Searching for alluvial gold deposits off Nova Scotia: Ocean Industry, v. 4, no. 1, p. 43–46, illus., 1969.

An offshore mineral exploration program, started in the summer of 1968 off the southeastern coast of Nova Scotia to locate and drill sample marine gold placers, completed 268 mi of seismic acoustic profiling and drilled 187 holes in alluvium. Seaward extensions of ancient and recent stream channels and of onshore gold-bearing structures, and scour channels and basins in gold-bearing areas were the targets; bathymetric charts were used to select priority areas. Gold values for the first area sampled, a buried channel, varied from a few cents to over four dollars per cubic yard. The largest deposit, found at the intersection of a fault and anticline, had values of about 30 cents per cubic yard. Middle reaches of streams offer the most favorable environment; notable gold yields were found in coarse gravels. A sample mining operation across the deposits is planned to assess extent, depth, and worth of each.—ESL

00243 **Liberty, Bruce A.** Black River stratigraphy and environment studies in southern Ontario [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 36–37, 1969.

Liebermann, Robert C. *See* Anderson, Orson L. 06109

00244 **Lindholm, R. C.** Carbonate petrology of the Onondaga Limestone (Middle Devonian), New York—A case for calcisiltite [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 37, 1969.

00124 **Lineback, Jerry A.** Illinois basin sediment-starved during Mississippian: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 112–126, illus., 1969.

The deeper part of the Illinois basin had water depths of as much as 1,000 feet but received little or no sediment during early Middle Mississippian (Valmeyeran) time. Burlington and Keokuk Limestones were deposited in shallow water at the west edge of the basin while little or no sediment reached the deep part; the Borden Siltstone delta complex then filled part of the basin and extended on to the adjoining western shelf, but only thin equivalent Springville Shale was deposited in deeper water beyond thick deltaic accumulation; Fort Payne Formation and Ullin Limestone filled the remaining deep water areas. Progradation of foreset slopes several hundred feet high was effective in basin filling and is likened to present deposition along continental margins of the sediment-starved ocean basins.—EGS

05877 **Lingard, Amos L.; Roberts, W. L.** Sampling of pegmatite dumps, Black Hills, South Dakota, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 191–193, tables, 1968.

The sampling and analytical methods employed in the investigation of the Ingersoll and Tin Mountain mine dumps are described briefly. A current check list of all known Black Hills pegmatite minerals (134) is included. The studies had a two-fold purpose: to determine the economic feasibility of working the mine dumps, and to study and preserve minerals of scientific value. They included surveying,

mapping, trenching, sampling and analysis by X-ray and emission spectroscopy.—HRC

05959 **Lishman, J. R.** Use of the Sidewall Neutron log in the Keg River Formation of the Zama area, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. A1–A10, illus., 1968.

First use of the Sidewall Epithermal Neutron Porosity log suggests that it is an excellent porosity device for carbonate sections. It offers advantages over both the more established methods of logging porosity, i.e., acoustic velocity and gamma-gamma density logging. The Sidewall Neutron log appears to show very little difference in response between limestone and dolomite sections, so that no great error is induced by misidentifying the rock type. The Sidewall Epithermal Neutron Porosity log is useful in combination with other porosity devices (especially a density log) for determining mineralogy. Results have been checked against X-ray diffraction studies and thin section work. Some problems exist in present techniques for using a computer to calculate percentages of component minerals, but the full potential of the method has probably not yet been exploited.—Author's abstract

Lloyd, Barbara S. *See* Brooks, David B. 06102

Loeblich, A. R., 3d. *See* Loeblich, A. R., Jr. 00109

00109 **Loeblich, A. R., Jr.; Loeblich, A. R., 3d.** Index to the genera, subgenera, and sections of the Pyrrhophyta, [Pt.] 3: Jour. Paleontology, v. 43, no. 1, p. 193–198, 1969.

Living and fossil genera of Pyrrhophyta (dinoflagellates) are cataloged, with annotations regarding their nomenclatural validity; ebridians (Ebriida) are treated as a class within the Pyrrhophyta. Included are 126 entries and a bibliography of 78 references.—SHM

Loeblich, Alfred R., Jr. *See* Tappan, Helen. 06032

06347 **Loeblich, Alfred R., Jr.; Drugg, Warren S.** New acritarchs from the Early Devonian (Late Gedinnian) Haragan Formation of Oklahoma, U.S.A.: Tulane Studies Geology, v. 6, no. 4, p. 129–137, illus., 1968.

Three distinctive new genera of acritarchs, microplankton of probable algal origin, are described from a shaly interval in the lower part of the Haragan Formation west of Clarita, Coal County, Okla. *Ozotobrachion* includes two new species: *O. dactylos* (type species) and *O. dicros*. *Fimbriaglomerella* (type species, *F. divisa*) and *Riculasphaera* (type species, *R. fissa*) are both, for the present, monotypic.—*from* Authors' abstract

00156 **Londe, Pierre; Vigier, Gaston; Vormeringer, Raymond.** Stability of rock slopes, a three-dimensional study: Am. Soc. Civil Engineers Proc., v. 95, paper 6363, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 235–262, illus., 1969.

The stability of a rock slope or foundation is analyzed in terms of sliding along geological surfaces of separation. The proposed method considers rock volumes limited by three internal plane surfaces and the natural ground surface. The applied forces are weight, external loads, pore pressure. The resistance to sliding is due to friction on the planes of separation. The equilibrium is three-dimensional. Geometry, kinematics, and statics are first described, assuming that movement can only be translation. The traces of forces and planes on a unit sphere are used for an exhaustive discussion of the problem. It is thus possible to compare the weight of the different parameters covering equilibrium, a comparison which has more meaning to the engineer than the computation of a so-called factor of safety.—Authors' abstract

00084 **Longwell, Chester R.; Flint, Richard Foster; Sanders, John E.** Physical geology: New York, John Wiley and Sons, 685 p., illus., tables, 1969.

This volume is not merely a revision of the Longwell–Flint *Introduction to physical geology* (1962); certain rewritten chapters follow the pattern of the earlier book, but the majority have been reworked with the treatment of topics reorganized along a central corridor that represents the geologic cycle as first set forth by James Hutton. The 21 chapters are divided into five parts: the Earth as a whole, external processes and configurations, internal processes and configurations, evolution of the lithosphere, and geology in industry. Appendixes contain some physical and chemical concepts, minerals, rocks, maps, cross sections, and field measurements, and metric–English conversion tables. An extensive glossary and a subject index are included.—MCM

Lotse, E. G. *See* Dolcater, D. L. 05961

00130 **Love, J. D.; Keefer, W.R.** Type locality of Darby Formation, western Wyoming: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 167–170, illus., 1969.

A misconception as to the whereabouts of the type locality of the Darby Formation (largely Devonian), introduced in several recent reports, has led to erroneous conclusions regarding the stratigraphic nomenclature and correlation of this unit in parts of western Wyoming. This has come about because some authors interpreted "typical section" to mean "type section." No type section of the Darby Formation has ever been designated, only a type locality, which is in the canyon of Darby Creek in the Teton Range. A typical section is on Sheep Mountain in the Wind River Range, 60 mi southeast.—Authors' abstract

05987 **Love, J. D.; Reed, John C., Jr.** Creation of the Teton landscape—The geologic story of Grand Teton National Park: [Moose, Wyo.] Grand Teton Nat. History Assoc., 120 p., illus., 1968.

Precambrian rocks form the core of the Tetons, and in the Paleozoic, an outstanding rock and fossil record accumulated. The Mesozoic was a time of alternating marine, transitional, and continental environments. At the end of the Cretaceous, the first crustal movement in the area began, and in the Cenozoic, the peaks rose in their present form, and are still rising. Subsiding basins preserved the thickest and most complete Tertiary record in the United States. Eocene coal swamps formed in the east, and the Oligocene and Miocene were times of intense volcanic activity. The Hoback normal fault developed about two million years ago, and more lavas were extruded near Jackson. Glaciers invaded Jackson Hole at least three times, and left a large outwash fan of quartzite boulders, prominent moraines, and some lakes. About a dozen small glaciers exist today.—ESL

06022 **Lowman, Paul D., Jr.** Space panorama: Zurich, Switzerland, WELTFLUGBILD Reinhold A. Müller, 68 photographs with text, 1968.

Specific areas were selected for high-quality color photography of Earth's terrain, taken by astronauts on Gemini flights as part of an experiment in orbital photography for geologic, geographic, and oceanographic study, particularly of physiographic regions whose size makes difficult their study by conventional techniques. This book is a collection of some of the best pictures, each accompanied by a brief explanation of prominent geologic features. Eighteen of them taken over North America, 23 over Africa, and 17 over Asia show outstandingly sharp features of deserts, rifts, outcrop and stream patterns, and volcanic areas. Ocean depths and cloud formations are of interest also.—GDC

00245 **Ludman, Allan.** Structure and stratigraphy of Silurian rocks in the Skowhegan area, south-central Maine [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 37–38, 1969.

06159 **Luebke, William C.; Johnson, Gerald H.** The geology of the Mears Corner pit, Virginia Beach, Virginia [abs.]: Virginia Jour. Sci., v. 19, no. 3, p. 194, 1968.

Lundgren, L. W., Jr. *See* Dixon, H. Roberta. 06044

00219 **Lundgren, Lawrence, Jr.** Cataclastic deformation of the Hebron Formation, southeastern Connecticut [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 38, 1969.

06001 **Lundgren, Lawrence W., Jr.** Honey Hill and Lake Char faults, Trip F-1 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 8 p., paged separately, illus., 1968.

Sixteen field trip stops in northeastern Connecticut are described at various areas in which the faults can be demonstrated. Blastomylonites and ultramylonites are to be seen in the Chester area, and the origin of these features is discussed. Cataclastic rocks, developed from the Hebron, Tatnic Hill and Canterbury Formations, and from pegmatites in these rocks,are well displayed in Gillette Castle State Park. Structurally discordant rocks occur on either side of the fault in the Trading Cove Brook area. Exposures in the Billings Lake, Plainfield, and the Old Lyme and Essex areas are described also.—HRC

06322 **Lundin, Robert F.** Ostracodes of the Haragan Formation (Devonian) in Oklahoma: Oklahoma Geol. Survey Bull. 116, 121 p., illus., tables, 1968.

The Haragan Formation throughout its outcrop area in south-central Oklahoma represents a distinct stratigraphic unit with a single ostracode fauna devoid of stratigraphic zones. This large and diversified fauna contains 54 species (13 new) representing 17 families and 28 genera, and indicates correlation with the Birdsong Shale of western Tennessee, and the Kalkberg and New Scotland Limestones of New York. The Haragan is interpreted as a facies of the overlying Bois d'Arc Formation,as most Bois d'Arc ostracode species are present in the Haragan. An unconformity at the Silurian–Devonian boundary is indicated between the Haragan and the underlying Silurian Henryhouse; the two ostracode faunas are 100 percent distinct at the specific level and 50 percent distinct at the generic level, and there is no gradational fauna or interfingering of strata. —VMJ

Lyall, Anil K. *See* Swift, Donald J. P. 06123

Lynch, Betty M. *See* Willman, H. B. 06015

00151 **Lyons, Richard T.** Memorial, Russell Scott McFarland (1893–1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 186–187, portrait, 1969.

MacDonald, Catheryn. *See* Taft, William H. 06319

06023 **MacDonald, William D.** Continental drift and the Caribbean (Desplazamiento continental y el Caribe): Asoc. Venezolana Geología Minería y Petrôleo Bol. Inf., v. 11, no. 1, p. 17–23, table, 1968.

Some old and some relatively new criteria by which continental drift can be recognized are reviewed, and their application to the Caribbean area is examined. Pre-existing margins have been obliterated by later tectonics. Some comments are made also on Rod's (1967) paleotectonic reconstruction,in which he incorporates the Greater Antilles into the former Appalachian trend. All evidence indicates a mid-Mesozoic and younger age for the Antilles.Paleomagnetic information is scarce in the area, but may be of the greatest value in unraveling the geologic history of the Caribbean region.—ESL

Mackenzie, Fred T. *See* Garrels, Robert M. 00145

06339 **Macpherson, Joyce Brown.** The physiographic evolution of the Montreal archipelago [with French abs.]: Canadian Geographer, v. 12, no. 4, p. 254–265, 278, illus., 1968.

Contrast between the uninterrupted course of the St. Lawrence on the east side of Montreal Island and downstream, with the irregular profiles of other water courses in the area, is due to bedrock structure and lithology. The pre-Wisconsin Ottawa River was probably already incised within the Oka-Rigaud massif, having

been superimposed from a sedimentary cover. The present St. Lawrence River above the Ottawa confluence bears no relation to the buried drainage pattern, but below Montreal Harbour it follows the line of a preglacial strike stream. The ancestral Ottawa valley may lie north of Île Jésus and intersect the preglacial valley followed by the present St. Lawrence. Champlain Sea emergence stages described in detail are Riguad, Rigaud–Montreal interval, and the Montreal and later stages. Relations between St. Pierre channel and Lachine Rapids and Lake St. Louis levels are traced.—ESL

Madsen, Beth M. *See* Jones, Charles L. 05984

Maenaka, Kazuaki. *See* Sasajima, Sadao. 00074

Mairs, Robert L. *See* Pruna, Andres. 00079

05962 **Malcolm, R. L.; McCracken, R. J.** Canopy drip—A source of mobile soil organic matter for mobilization of iron and aluminum: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 834–838, tables, 1968.

Leaf leachates, simulating canopy drip during rainfall, were collected from red oak, live oak, and longleaf pine trees, the principal species growing on soils with spodic horizons on the North Carolina Coastal Plain near Ft. Caswell. From the canopy drip samples, chilled, filtered, and freeze dried, it was estimated that about 20 kg/ha per yr of organic matter could be contributed to the soil from this source. In the laboratory, Fe and Al complexed from nitrate salt solutions, depending on the concentration of leachate solution, amounted to a possible field mobilization of 0.15–1.53 and 0.22–0.70 kg/ha per yr, respectively. Active components responsible for Fe and Al mobilization were determined to be polyphenols, reducing-sugars, and organic acids. Canopy drip was thus shown to be an important source of mobile soil organic matter for podzolization and other pedogenic processes.—*from* Authors' abstract

00220 **Manspeizer, Warren.** Radial and concentric joints, First Watchung Mountains, New Jersey [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 38–39, 1969.

00221 **Manspeizer, Warren.** The Catskill delta complex—Distributaries in the Bradford subdelta [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 39, 1969.

00061 **Mao, Ho-Kwang; Takahashi, Taro; Bassett, William A.; Weaver, J. Scott.** Effect of pressure and temperature on the molar volumes of wüstite and of three $(Fe,Mg)_2SiO_4$ spinel solid solutions: Jour. Geophys. Research, v. 74, no. 4, p. 1061–1069, illus., tables, 1969.

The effect of pressure on molar volumes of wüstite and three spinel phases of olivines has been determined by means of X-ray diffraction at pressures up to 255 kb at room temperatures. Isothermal bulk moduli for these minerals have been evaluated at zero pressure from volume data by a least-squares fit to the Birch equation. The value for wüstite thus determined is 1.42±0.10 Mr; values for spinel phases of olivines range between 1.96 and 2.12±0.10 Mb and are indistinguishable from each other. The mean volume thermal expansivity for the spinel phase of Fe_2SiO_4 is $(23\pm1)\times10^{-6}$ °C^{-1} at 1 bar pressure and a temperature range of 8°–396°C. On the basis of these data, the stability boundary for an assumed reaction, Fe_2SiO_4 (spinel) = 2 FeO (wüstite) + SiO_2 (stishovite), is P (kb) = 227.5 – 0.022 T(°C).—*from* Authors' abstract

Marinenko, John. *See* Millard, Hugh T., Jr. 00083

00175 **Marsal, Raul J.** Drained strength characteristics of sands—Discussion [of paper 5561 by K. L. Lee and H. B. Seed, 1967]: Am. Soc. Civil Engineers Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 349–352, illus., 1969.

The comprehensive research presented by Lee and Seed (ibid., v. 93, no. SM 6, p. 17–39) is a valuable contribution to the study of granular soils. Parallelism in the behavior of sands tested at high confining pressures and that of rockfill materials is worth noting. The drained shear strength of Sacramento River sands is analyzed in an attempt to explain the statistically complex phenomena underlying the behavior of cohesionless soils.—ESL

Martin, Charles W. *See* Gates, Robert M. 05999

Matelski, R. P. *See* Petersen, G. W. 05934

Matlock, William G. *See* Sorey, Michael L. 00087

Matsusaka, Yoshito. *See* Sherman, G. Donald. 00091

06341 **Mauer, Larry G.; Parker, P. L.** A study of the geochemistry of vitamin B_{12}: Contr. Marine Sci., v. 13, p. 29–42, illus., tables, 1968.

Vitamin B–12, a cobalt porphyrin, has been quantiatively measured in Recent sediments from several environments along the Texas coast; samples of sediments from offshore southern California and Antarctica and samples of crude oil, oil shale, and other organic matter, of Early Cretaceous age and younger, were also analyzed to see how far back in geologic time the B–12 could be detected. The upper few cm of the Recent sediment is rich in B–12, but at a depth of about one meter the B–12 is not detectable. Microorganisms living near the surface of the sediment are probably supplying B–12 to the overlying waters via the interstitial waters. B–12 is noticeably degraded within a geologically short time span, so it does not show much promise as a biological marker except in Recent sediments.—VMJ

McAndrews, John H. *See* Calkin, Parker E. 00279

00166 **McCarthy, J. H.,Jr.; Vaughn, W.W.; Learned, R. E.; Meuschke, J. L.** Mercury in soil gas and air—A potential tool in mineral exploration: U.S. Geol. Survey Circ. 609, 16 p., illus., table, 1969.

The mercury content in soil gas and in the atmosphere was measured in several mining districts to test the possibility that the mercury content in the atmosphere is higher over ore deposits than over barren ground. At Cortez, Nev., the distribution of anomalous amounts of mercury in the air collected at ground level (soil gas) correlates well with the distribution of gold-bearing rocks that are covered by as much as 100 feet of gravel. The mercury content in the atmosphere collected at an altitude of 200 feet by an aircraft was 20 times background over a mercury deposit and 10 times background over two porphyry copper deposits. Measurement of mercury in soil gas and air may prove to be a valuable exploration tool.—Authors' abstract

00135 **McCave, I. N.** Correlation of marine and nonmarine strata with examples from Devonian of New York State: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 155–162, illus., 1969.

Middle and Upper Devonian rocks of New York record an east-to-west marine regression (the Catskill Delta). On the marine side, the Tully and Portland Point limestones mark two transgressive events. Analyses of structure and thickness trends permit predictions of the stratigraphic positions of nonmarine strata equivalent to these limestones. The Holocene rise of sea level caused widespread alluviation and high rates of sedimentation in the lower floodplains of many rivers, and ancient transgressions probably did the same. In the nonmarine Devonian section, anomalously thick overbank alluvial deposits were found at the positions predicted for the Tully and Portland Point limestones.—BHK

05897 **McConnell, Robert K., Jr.** Viscosity of the Earth's mantle, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf.Contr.: Princeton, N. J., Princeton Univ. Press, p. 45–57, illus., discussion, 1968.

Contradictions between viscosities predicted from long wavelength and short wavelength deformations are analyzed, and it is concluded that a steeper gradient must be accepted for the region between 200 and 400 km than has previously been estimated. The strong viscosity contrasts implied by the data suggest that crustal drift is caused by an upper mantle mechanism rather than by lower mantle convection.—MS

McCracken, R. J. *See* Malcolm, R. L. 05962

McGowen, J. H. *See* Fisher, W. L. 00147

05996 **McGregor, A. A.; Biggs, Charles A.** The Bell Creek Field—A rich stratigraphic trap, Powder River and Carter Counties, Montana [abs.]: Corpus Christi Geol. Soc. Bull., v. 9, no. 2, p. 3–4, 1968.

McGregor, Alexander A. *See* Biggs, Charles A. 05908

McGugan, Alan. *See* Arai, Mary Needler. 00122

00165 **McGuinness, C. L.** Scientific or rule-of-thumb techniques of ground-water management—Which will prevail?: U.S. Geol. Survey Circ. 608, 8 p., 1969.

Current trends towards management of aquifers as possible regulating reservoirs managed conjunctively with surface water require vast amounts of data and a much better understanding of aquifer-system behavior than now exists. Stratigraphy is a primary determinant of both internal and boundary characteristics of aquifer systems, but since minor features may make aquifers transcend stratigraphic boundaries, there is a need for ways of defining aquifer boundaries and quantifying aquifer and confining-bed characteristics that are different from ordinary stratigraphic techniques. Only when aquifer characteristics can be predicted routinely can they be inserted into a master model that incorporates hydrologic and socioeconomic facts for intelligent social actions involving water.—VSN

McGuire, Robert C. *See* Tettenhorst, Rodney. 05967

06177 **McIntyre, Donald B.; Pollard, David D.; Smith, Roger.** Computer programs for automatic contouring: Kansas Geol. Survey Computer Contr. 23, 76 p., illus., 1968.

The purpose of the programs, which comprise most of this paper, is to plot contoured maps with irregularly spaced data, trend surfaces, and residuals. The program listed is based on a square grid, the points of which are determined by second-degree trend surfaces fitted to the nearest stations; it has been tested and used for several years. Notes on program listings and test data for the trend are included. Two maps based on 100 random points illustrate the product.—ESL

00222 **McKague, H. Lawrence.** The effects of serpentinization upon the trace element distribution in the State Line serpentinite [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 39–40, 1969.

00111 **McKee, Edwin D.; Goldberg, Moshe.** Experiments on formation of contorted structures in mud: Geol. Soc. America Bull., v. 80, no. 2, p. 231–243, illus., tables, 1969.

Contorted structures can be formed in mud or sand as a result of differential loading. Fifteen sets of experiments were conducted in water tanks to test various factors of possible significance in the contortion of mud by loading. The most significant factor was distribution of load; others included the manner of depositing the mud, the form of the underlying surface, the direction of loading, and the movement or lack of movement of water during loading. Contortions ranged from simple upright anticlines, to structures with gently dipping axial planes, to others with lateral extensions from the apexes, and, finally, to those with complex overturned folds. Some additional forms of contorted bedding result from other types of penecontemporaneous deformation such as slumping from undermining or oversteepening, differential lateral movement, and surface drag; these forms differ from the structures formed by loading.—*from* Authors' abstract

05983 **McKee, Edwin H.** Geology of the Magruder Mountain area, Nevada–California: U.S. Geol. Survey Bull. 1251–H, p. H1–H40, illus., geol. map, 1968.

The oldest rocks exposed in the Magruder Mountain area are Precambrian, Cambrian, and Ordovician strata; these are intruded by Middle Jurassic granitic rocks and are conformably overlain by late Tertiary and Quaternary sedimentary and volcanic rocks. The more than 15,000 feet of Precambrian and Cambrian strata constitute a conformable sequence of limestone, sandstone, and siltstone very similar to the classic Waucoban section of the Inyo Range to the west. Ordovician rocks include graptolitic shale and chert of Middle Ordovician age. The relationship of these rocks to the Cambrian strata is unclear, but possibly the Ordovician rocks are allochthonous. The largest structural feature in the area is the Death Valley–Furnace Creek fault zone, along which there has apparently been at least 20 miles of right-lateral displacement.—EHM

06103 **McKelvey, Vincent E.** Mineral potential of the submerged parts of the continents, *in* Mineral resources of the world ocean—Symposium, Newport, R.I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, p. 31–38, illus., tables, 1968.

This is essentially the same as the paper published in Ocean Industry, v. 3, no. 9, p. 37–43, 1968, under the title "Mineral potential of the submerged parts of the U.S.," cited in Abstracts of North American Geology for February 1969.—VMJ

05896 **McKenzie, Dan P.** The geophysical importance of high-temperature creep, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor) Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 28–44, illus., discussion, 1968.

On the premise that the theory of creep processes suggesting that temperature rather than pressure determines the creep mechanism, deformation of dense mantle materials is considered to resemble that of low-porosity ceramics at high temperature and at atmospheric pressure. A model for steady-state creep in the mantle is derived from results of experimental investigations of creep in ceramic materials. The data indicate that diffusion creep and dislocation climb are the two mechanisms involved in mantle processes.—MS

00231 **McKinney, T. F.; Friedman, Gerald M.** Sediments of the continental shelf off Long Island, New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 40–41, 1969.

McLane, John E. *See* Millard, Hugh T., Jr. 00083

06008 **McLean, Dewey M.** Reworked palynomorphs in the Paleocene Naheola Formation of southwest Alabama: Jour. Paleontology, v. 42, no. 6, p. 1478–1485, illus., 1968.

A search for dinoflagellates in the upper Paleocene Naheola Formation of Wilcox County, Ala., has disclosed numerous reworked Paleozoic and Mesozoic palynomorphs, including some unsuspected Jurassic and Lower Cretaceous specimens; an attempt is made to relate these to their source sediments. Jurassic and Lower Cretaceous sediments, although known in the subsurface, have not been demonstrated to crop out east of the Mississippi River. The presence of the reworked palynomorphs in the Naheola Formation suggests that sediments of these ages extended to the surface in central Alabama during late Paleocene time and supports the suspicion that an outcrop of undated sediments in central Alabama, the Vick Formation, may be of pre-Tuscaloosa Mesozoic age.—*from* Author's abstract

00232 **McLeroy, Donald F.** Genesis of certain Precambrian banded iron deposits [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 41, 1969.

McManus, Dean A. *See* Carson, Bobb. 00076

06309 **McPherson, H. J.** Historical development of the lower Red Deer Valley, Alberta [with French abs.]: Canadian Geographer, v. 12, no. 4, p. 227–240, 278, illus., tables, 1968.

The historical evolution and landform assemblages of the lowest 130 mi of the Red Deer Valley are described. Bedrock formations consist of a Late Cretaceous series of marine and nonmarine sandstones and shales. Physiographic features described are: the preglacial drainage system, the modern floodplain, fine-grained alluvial terraces, sand dunes, alluvial fans, slump and badland topography, abandoned river courses, sand and gravel terraces, and till landforms. A sequence of events comprising five stages in development and landform assemblages is described and depicted in an idealized diagram.—ESL

06085 **McWilliams, R. G.; Newton, J. G.; Scott, J. C.** Geologic map of Crenshaw County, Alabama: Alabama Geol. Survey Map 68, scale about 1 in. to 2 mi., text, 1968.

Late Cretaceouu to Holocene units that crop out in Crenshaw County are sedimentary in origin; in ascending order, they are: Cretaceous Selma Group (Demopolis Chalk, Ripley Formation, and Providence Sand); Tertiary Midway, Wilcox, and Claiborne Groups, and residuum; and Quaternary terrace and alluvial deposits.—MCM

06143 **Melickian, G. E.** Geophysical activity in 1967 applied to engineering, construction, and ground water products: Geophysics, v. 33, no. 6, p. 911–914, tables, 1968.

Data compiled from questionnaires sent out by the SEG Geophysical Activity Committee show that the total level of world activity in engineering, construction, and ground-water geophysics remained about the same in 1967, while the average costs decreased. It is felt that less than 50 percent of the total activity is being reported.—KAF

05869 **Menard, H. W.** Some remaining problems in sea-floor spreading, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 109–116, illus.; discussion, p. 116–118, 1968.

Although the symmetrical pattern of magnetic anomalies and seismicity of transform faults lend convincing support to sea-floor spreading theory, offsets of magnetic anomalies along fracture zones and certain facets of mechanism of sea-floor spreading are still unresolved problems. The concept of originally relatively straight and continuous oceanic ridges, whose crests subsequently migrated, and originally straight and continuous convection cells that subsequently decayed into smaller cells is a possible explanation for various problematic features. Transition from an early stage of large convection and simple crustal deformation to smaller convection cells and complex deformation may be a function of asymmetrical convection. Apparently magnetic anomalies can be produced by one-sided convection, shown by symmetrical distribution of magnetic anomalies and asymmetrical distribution of volcanoes associated with the Juan de Fuca submarine ridge.—MS

06101 **Menard, Henry W., Jr.** Marine geology, *in* Mineral resources of the world ocean—Symposium, Newport, R. I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, p. 7–8, 1968.

This is a summary of a talk entitled "The history of oceans and the development of modern oceans." The concepts of ocean-floor spreading and block tectonics, in which very large blocks of oceanic crust have moved across enormous distances and in various directions, are discussed in their implied relations to sedimentation, paleontology, and regional variations in chemical composition of the crust and of ores in metallogenic provinces.—VMJ

06132 **Menzies, Robert J.; Rowe, Gilbert T.** The LUBS, a large undisturbed bottom sampler: Limnology and Oceanography, v. 13, no. 4, p. 708–714, illus., table, 1968.

The LUBS (large undisturbed benthos sampler) satisfies many criteria for a successful soft-bottom quantitative sampler, for geologists and especially for biologists. The design is simple and inexpensive and the sample can be collected in its permanent container, a removable can. Stratified sediments are collected undisturbed, in large diameters (28 cm for smallest size). The sampler is designed with minimum frontal area and is permeable to water during descent (though watertight on pull-out), so that impact is not preceded by a shock wave that will wash away the vagrant epifauna. The LUBS has been designed specifically for quantitative investigation on soft-bottom communities in the deep sea; it works only in soft sediments (not at all in rock), but these cover most of the deep ocean floor.—VMJ

05948 **Mercer, R. F.** The use of flame ionization detection in oil exploration, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. F1–F10, illus., 1968.

The flame ionization detector (FID) is a valuable addition to wellsite hydrocarbon detection, the basic function of which is to detect and position with respect to depth, all hydrocarbon accumulations. Wellsite chromatography is used to analyze each hydrocarbon accumulation to include the identity and relative proportions of each component. Ionization detectors depend on conduction of electricity by gases. If electrically charged molecules are present in an applied electrical field, their motion in a fixed direction causes them to conduct. The number of ions produced in a flame of pure hydrogen burning in air is greatly affected by the presence of volatile carbon compounds. Gas molecules normally do not conduct and the increased conductivity due to the presence of very few ions which can be observed explains the great sensitivity of ionization detectors.—KAF

06110 **Merriam, Daniel F.; Cocke, Nan Carnahan.** (editors). Computer applications in the earth sciences—Colloquium on simulation: Kansas Geol. Survey Computer Contr. 22, 58 p., illus., tables, 1968.

Applications discussed in this fourth colloquium on computer applications in the earth sciences include logging methods, salt-dome development, stochastic processes in stratigraphic analysis, sedimentation rates, and delta building. Seven of the nine papers are cited separately.—ESL

05914 **Mettler, Donald E.** West Moorcroft and Wood Dakota fields, Crook County, Wyoming, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 89–94, illus., 1968.

It is proposed that oxbow-lake deposits, common to meandering stream channels, form the updip impermeable barriers which trap oil in the Dakota point-bar sandstones. This is the only reasonable interpretation that is compatible with regional land local data in the Dakota Sandstone of the West Moorcroft and Wood oil fields of Wyoming. Oxbow traps are difficult to find but are excellent reservoirs with high per-well reserves.—VSN

00233 **Metz, Robert.** Taconic stratigraphy of the Cambridge quadrangle, New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 41–42, 1969.

Meuschke, J.L. *See* McCarthy, J.H., Jr. 00166

06061 **Meyerhoff, G. G.** Discussion [of] Settlement of a furnace foundation, Sorel, Quebec by H. Q. Golder and J. C. Osler (v. 5, no. 1:46–56) [1968]: Canadian Geotech. Jour., v. 5, no. 4, p. 249–250, 1968.

Observed total settlements agree with estimates based on initial settlement of the sand, full consolidation of the interbedded silty clay, plus 50 percent consolidation of the upper part of the Leda clay. This smaller observed settlement may be due to effects of delayed consolidation which can lead to increased resistance against further consolidation. It is hoped that settlement observations of other structures on Leda clay will be analyzed in relation to delayed consolidation.—ESL

00083 **Millard, Hugh T., Jr.; Marinenko, John; McLane, John E.** Establishment of gold-quartz standard GQS-1: U.S. Geol. Survey Circ. 598, 6 p.,tables, 1969.

A homogeneous gold-quartz standard, GQS-1, was prepared from a heterogeneous gold-bearing quartz by chemical treatment. The concentration of gold in GQS-1 was determined by both instrumental neutron activation analysis and radioisotope dilution analysis to be 2.61 ± 0 ppm. Analysis of 10 samples of the standard by both instrumental neutron activation analysis and radioisotope dilution analysis failed to reveal heterogeneity within the standard. The precision of the analytical methods, expressed as standard error, was approximately 0.1 ppm. The analytical data were also used to estimate the average size of gold particles. The chemical treatment apparently reduced the average diameter of the gold particles by at least an order of magnitude and increased the concentration of gold grains by a factor of at least 4,000.—Authors' abstract

Miller, R. J. *See* Overman, A. R.05956

00168 **Miller, Thomas P.; Elliott, Raymond L.** Metalliferous deposits near Granite Mountain, eastern Seward Peninsula, Alaska: U.S. Geol. Survey Circ. 614, 19 p., illus., table, 1969.

New deposits of lead, zinc, and silver were found in a large altered zone 18 miles long and 2 to 5 miles wide near Quartz Creek west of Granite Mountain in the eastern Seward Peninsula, Alaska. New deposits of molybdenum, bismuth, and silver were found associated with a previously reported occurrence of uranium, copper, lead, and zinc minerals in the upper Peace River drainage northeast of Granite Mountain. Both groups of deposits are associated spatially with felsic plutonic rocks and occur near the western edge of a late Mesozoic province of volcanic plutonic rocks. Both groups of deposits warrant further investigation as possible exploration target areas.—Authors' abstract

Milliman, John D. *See* Gross, M. Grant. 00092

Mills, W.R. *See* Hilchie, D. W. 05951

06346 **Mísař, Zdeněk.** A contribution to the geomorphological history of the Sermilik Fjord area, Frederikshåb district, SW Greenland [with Czech. summ.]: Carolina Univ. Acta 1968, Geographica 1, p. 51-66, illus., 1968.

In the Frederikshåb area along the Sermilik Fjord many interesting geomorphological features such as glacial erosion levels, glacial cirques, valleys, tongues, and small scale features of glacial abrasion and also ice-dammed lakes were investigated during author's geological mapping and research in 1965 to 1966. All these features are described briefly in this article [and illustrated by drawings and photographs].—Author's abstract

00095 **Mogg, Joe L.** Step-drawdown test needs critical review: Ground Water, v. 7, no. 1, p. 28-34, illus., table, 1969.

A review of the literature and a study of a number of field tests shows that the presently used analysis and interpretation of step-drawdown tests can be misleading. The efficiency of a well is defined. The usefulness of the step-drawdown test is outlined and a hypothesis for reduction in specific capacity is offered.—Author's abstract

05881 **Mohl, K. L.; Bakken, W. E.** First day of field conference, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 215-225, illus., 1968.

The first day of a two day field trip begins in Deadwood, S.D., and follows a circle of about 330 miles to the east; numerous exposures and geologic phenomena are described. Stops are made at a Cretaceous bentonite mine near Belle Fourche, the Bell Creek oil field, and the Wyodak coal mine, all in northeastern Wyoming and southeastern Montana.—HRC

Moineau, Hervé. *See* Baro, Raymond. 05988

06042 **Molnia, Bruce Franklin.** Quartz grains—A method for determining provenance? [abs.]: Elisha Mitchell Sci.Soc. Jour., v. 84, no. 4, p. 438, 1968.

06314 **Monger, J. W. H.** Early Tertiary stratified rocks, Greenwood map-area (82 E/2), British Columbia: Canada Geol. Survey Paper 67-42, 39 p., illus., tables, geol.map, 1968.

Early Tertiary continental sedimentary and volcanic rocks and intrusive equivalents underlie much of this area. The Kettle River Formation, unconformable upon Cretaceous and older rocks, consists of materials derived from acidic and intermediate volcanics and basement rocks; its thickness ranges between several hundred and 4,000 feet. A partial facies equivalent, the overlying Marron Formation, 300 to 6,000 feet thick, comprises volcanic rocks; its stratigraphy is remarkably similar to that in the type area 30 miles east-northeast of Greenwood map-area. Except for a possible Oligocene slide breccia, the upper contact is a Pleistocene or Recent erosion surface. Block faults cut by normal faults have displacements up to 6,000 feet, some early Tertiary in age but most later. Large anticlines arched Tertiary stratified rocks over intrusions equivalent to the lower Marron extrusives.—*from* Author's abstract

06330 **Moore, George W.; Silver, Eli A.** Gold distribution on the sea floor off the Klamath Mountains, California: U.S. Geol. Survey Circ. 605, 9 p., illus., table, 1968.

Analyses of 82 samples collected from the surface of the continental shelf between the Oregon-California border and Eureka, Calif., indicate the background gold content is about 0.1 ppb. Four anomalous tracts, from 10-30 sq km in extent, have gold values above 10 ppb; the richest sample contains 390 ppb. Anomalous areas lack close correlation with water depth, but are related to areas underlain by Cenozoic strata that contain small quantities of dispersed gold originally derived from lodes in the Klamath Mts. This relationship suggests that offshore gold accumulations are lag concentrates produced from Cenozoic deposits by wave erosion during postglacial rise in sea level. Gold contents at the surface are too low for economic recovery, and drilling will be required to determine whether anomalous areas are underlain by higher grade material.—*from* Authors' abstract

06031 **Moore, Raymond C.** (and others). Developments, trends and outlooks in paleontology: Jour. Paleontology, v. 42, no. 6, p. 1327-1377, 1968.

Fifty-two specialists in various aspects of paleontology discuss the history, current status, and future prospects of their fields. Moore concludes that the next half-century will witness yet more important and exciting advances in knowledge about past life on Earth than did the past half-century.—REG

06007 **Moussa, Mounir T.** Fossil tracks from the Green River Formation (Eocene) near Soldier Summit, Utah: Jour. Paleontology, v. 42, no. 6, p. 1433-1438, illus., 1968.

Numerous well-preserved bird, mammal, and insect-larva? tracks were discovered in the lowermost part of the delta facies of the middle Eocene Green River Formation. The area was probably a near-shore shelf area of the Eocene Uinta Lake that frequently became an emergent mudflat. The preservation of the tracks provides a record of an organic community that is not known from conventional skeletal remains in this area. The level to which animal tracks may be classified taxonomically depends upon the group represented, the geologic age of the tracks, the tracking conditions, and the variations resulting from differences among the individuals of a particular species.—*from* Author's abstract

06138 **Moussa, Mounir T.** Gravitational gliding in the Flagstaff Formation near Soldier Summit, Utah: Brigham Young Univ. Geology Studies, v. 15, pt. 1, p. 77-84, illus., 1968.

Twenty-seven secondary structural ridges superimposed on the southeastern flank of Clear Creek anticline between Soldier Summit and Colton, Utah, are here interpreted as caused by gravitational gliding of the uppermost limestone beds of the Flagstaff Formation which form dip slopes along this flank of the anticline. The gravity structures, parallel to the regional strike of the beds, are classified into 'wrinkle' folds, fractured 'wrinkle' folds, and slip sheets, representing stages in the process of gravitational gliding probably started during the latest cycle of erosion, when a considerable part of the overlying Colton Formation had been stripped off. The limestone beds under their own weight started to glide into folds which became steeper, then fractured, and finally broke off along the crest and overrode the lower limb.—*from* Author's abstract

00234 **Moxham, R. L.** Distribution of Cu, Pb, and Zn in surficial materials near Shawangunk Mountain, New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 42, 1969.

00113 **Muffler, L. J. Patrick; White, Donald E.** Active metamorphism of upper Cenozoic sediments in the Salton Sea geothermal field and the Salton Trough, southeastern California: Geol. Soc. America Bull., v. 80, no. 2, p. 157–181, illus., tables, 1969.

Pliocene and Quaternary sediments are being transformed to rocks of greenschist facies at temperatures up to 360°C at 7100 feet, and in the presence of a geothermal brine containing over 250,000 ppm dissolved solids, primarily Cl, Na, Ca, K and Fe. Some transformations involve exchange with the brine, others do not. Original sediments consisted of quartz, calcite, K-feldspar, plagioclase, montmorillonite, illite, dolomite and kaolinite. Montmorillonite is converted to illite at about 100°C, and illite-montmorillonite to K-mica at about 210°C. Ankerite forms at about 120°C. Dolomite, ankerite, kaolinite and Fe^{++} react to chlorite, calcite and CO_2 at about 180°C. At about 300°C epidote and K-feldspar become abundant, calcite disappears, and K-mica is sporadic. The most common assemblage above 300°C is quartz + epidote + chlorite + K-feldspar + albite ± K-mica. No zeolites have been found.—WPB

Muilenburg, Garrett A. *See* Keller, Walter D. 05975

06082 **Mulligan, Robert.** Geology of Canadian beryllium deposits [with French abs.]: Canada Geol. Survey Econ. Geology Rept. 23, 109 p., illus., tables, geol. maps, 1968.

Beryllium occurrences, widespread in the Canadian Shield, are confined in the Cordilleran region to an eastern metamorphic belt, and in the Appalachian region to batholithic belts. Mostly in pegmatitic dikes within masses of granite, richer dikes of the Slave and Superior provinces are associated with lithium, but not in comparable concentrations; at Lacorne, Quebec, a by-product beryl associated with molybdenite is the only current beryllium production in Canada. Nonpegmatitic berylliferous quartz-greisen veins in both mountain regions are associated with wolframite and/or molybdenite. A unique alkali-metasomatic deposit at Seal Lake, Quebec, is related to syenite. Types of deposits formed depend on the metamorphic, intrusive, and tectonic history of the area, and chemistry of residual fluids and of depositional environment. A few significant foreign deposits, not known to Canada, are mentioned.—GDC

05888 **Murchison, Duncan; Westoll, T. Stanley.** (editors). Coal and coal-bearing strata: New York, American Elsevier Publishing Co., 418 p., illus., tables, 1968.

The 15 papers in this volume are based on contributions to the 13th Inter-University Geological Congress, held at the University of Newcastle upon Tyne, England, January 4–7, 1965. The papers are arranged under five parts: coal as a rock, sedimentary and biological environments of coal formation, geochemistry and metamorphism, and some aspects of coal basins. Three papers are cited separately.—ESL

06027 **Murray, C. Richard.** Estimated use of water in the United States, 1965: U.S. Geol. Survey Circ. 556, 53 p., illus., tables, 1968.

Estimates of water use in the United States for 1965 for public supply, rural domestic and livestock, irrigation, and industrial uses were about 1,600 gal per capita per day, an increase of 15 percent over 1960. Freshwater withdrawals for thermoelectric power generation increased nearly 25 percent, and saline water withdrawal 33 percent during the five years. Sixty-one bgd of ground water and 250 bgd of surface water were withdrawn; saline water used by industry increased 36 percent from 1960 to 1965. Annual streamflow in the United States was about four times withdrawals for all purposes. In addition to tabulations of water-use data by States and by regions, water-use tables are given for regions recently defined by the Water Resources Council for national assessment.—*from* Author's abstract

00235 **Murray, R. C.** Hypothesis for the formation of a carbonate-evaporite basin [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 42–43, 1969.

Nash, J. Thomas. *See* Brophy, Gerald P. 05970

Neave, K. G. *See* Clee, T. E. 00062

00068 **Neill, C. R.** Bed forms in the lower Red Deer River, Alberta: Jour. Hydrology, v. 7, no. 1, p. 58–85, illus., tables, 1969.

Air photographs and echo soundings made at various times over a period of four years on the Red Deer River near Duchess, Alberta, revealed a complex system of both large- and small-scale features or wave forms on the sandy bed of the river. It is shown that the features, and with them the bed elevations at certain points, change considerably from time to time, and that minor forms in particular change size rapidly in response to changes in flow. The observations are discussed in terms of recent efforts towards classification of river-bed forms and towards relating their properties to hydraulic factors. It is suggested that very detailed and extensive field observations would be needed to fully describe bed topography and its changes at similar locations, and that laboratory observations of bed forms in flumes do not in general reflect the extreme complexity of river situations.—*from* Author's abstract

06077 **Nettleton, Wiley D.; Flach, Klaus W.; Borst, George.** A toposequence of soils in tonalite grus in the southern California Peninsular Range: U.S. Soil Conserv. Service Soil Survey Inv. Rept. 21, 41 p., illus., tables, 1968.

Four kinds of soil in the San Luis Rey watershed were studied. Vista and Fallbrook soils, in which primarily biotites have been decomposed, represent a low-intensity weathering environment; major weathering products are vermiculite in Vista soils and vermiculite and kaolinite in Fallbrook. Bonsall soils represent a weathering environment of intermediate intensity; biotite weathers to vermiculite and kaolinite, and feldspar to montmorillonite. Bosanko soils reflect an environment of maximum parent-rock decomposition; biotite has weathered to vermiculite and montmorillonite, and feldspar to montmorillonite. Three degrees of B-horizon development are shown, largely a result of differences in weathering environment, and in the kind and amount of clay formed by weathering of grus. Illite is important in the A-horizon in the Vista, Fallbrook, and Bonsall soils, and in the B-horizon of Fallbrook.—ESL

05939 **New England Intercoll. Geol. Conf.; Orville, Philip M.** (editor). Guidebook for field trips in Connecticut, 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, sections paged separately, illus., tables, 1968.

This guidebook contains, besides a brief summary of the history of geologic investigation in Connecticut, description and maps for 20 different field trips, all but one day long. Two trips deal with glacial geology in Connecticut, two with hydrogeology and engineering geology, five with Triassic geology, four with metamorphic and regional geology, one with sedimentation, and five others with miscellaneous regional topics in Connecticut. Each is cited separately.—HRC

00236 **Newman, Walter S.; Zeiss, Harvey S.; Thurber, David L.; Rokach, Allan.** Quaternary of the Hudson River estuary—A preliminary report [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 43, 1969.

Newton, J. G. *See* McWilliams, R. G. 06085

06083 **Newton, John G.** Geologic map of Dale County, Alabama: Alabama Geol. Survey Map 63, scale about 1 in. to 2 mi., text, 1968.

Geologic units that crop out in Dale County are of sedimentary origin and range in age from Eocene to Holocene; in ascending order, they are: Eocene Nanafalia Formation, Tuscahoma Sand, Tallahatta and Hatchetigbee Formations undifferentiated, and Libson Formation; Eocene–Miocene residuum; and Quaternary terrace and alluvial deposits. All units yield water or are potential sources of water for domestic use; principal aquifers, Ripley and Clayton Formations and Providence Sand, will yield up to 2 mgd. Other resources are brown iron ore, sand and gravel, and clay.—MCM

06086 **Newton, John G.** Geologic map of Henry County, Alabama: Alabama Geol. Survey Map 70, scale about 1 in. to 2 mi., text, 1968.

Outcropping units of sedimentary origin in Henry County range in age from Cretaceous to Holocene;in ascending order they are: Upper Cretaceous Providence Sand; Paleocene Clayton Formation; Eocene Nanafalia Formation, Tuscahoma Sand, Tallahatta and Hatchetigbee Formations undifferentiated, and Lisbon Formation; Eocene,Oligocene,and Miocene residuum;and Quaternary terrace and alluvial deposits. All units are potential sources of water for domestic use, largest being in the Cretaceous Ripley Formation and Tuscaloosa Group and in a combination of permeable zones in the Clayton Formation and Providence Sand. Resources of economic interest are brown iron ore, bauxite, clay, sand and gravel, and limestone.—MCM

05872 **Nicholls, G. D.** The geochemistry of coal–bearing strata, *in* Coal and coal bearing strata (D. Murchison and T. S. Westoll, editors): New York, American Elsevier Publishing Co.,p. 269–307, illus., tables, 1968.

Possible causes of enrichment of various elements in coal include primary biogenic concentration, precipitation or sorbtion during coal formation, and concentration by selective leaching during consolidation. Data on geochemistry of seat earths support the view that they are shallow–water swamp sediments in acid waters, not leached horizons. Attempts to establish geochemical differences between marine and nonmarine sediments indicate boron is more abundant in marine than in freshwater shales, but no relationship is of widespread and general application. Most trace elements in sedimentary rocks were present in lattices of detrital minerals when they were deposited. Shales and mudstones in coal–bearing strata can be classified into geochemical facies representing progressively more oxidizing conditions. Fluctuations in chemical environment must be considered also.—ESL

06013 **Nichols, Thomas C., Jr.** Engineering geology of the Paducah East quadrangle in Kentucky: U.S. Geol. Survey Bull. 1258–A, p. A1–A13, illus., tables, 1968.

Field and laboratory investigations were conducted to determine the relation of geologic factors to engineering problems. An engineering geologic map delineates surface map units based on engineering properties as well as lithology. Field and laboratory test procedures and their significance are described. Interpretations are made of the probable behavior of lithologic units,shown on the map,when disturbed by normal engineering and construction practices. Interpretations are made also of the probable behavior of these same lithologic units in response to natural phenomena such as erosion, flooding,and earthquakes. Results of the investigation indicate that the Paducah area has many construction problems related to geologic factors and that site investigations are necessary for efficient land use.—*from* Author's abstract

06161 **Northern Miner Press Limited.** Mining explained: Toronto, Ontario, Northern Miner Press Ltd., 264 p., illus., 1968.

Some of the articles in this compilation have appeared in columns of the Northern Miner and were subsequently published in the book *Mining and milling explained*, which was succeeded in 1955 by *Mining explained in simple terms* (revised in 1963). Various individuals who cooperated in its revision and preparation of selected chapters, as well as authors of original articles are credited in the introduction. Chapter titles include: elementary geology, economic geology, scientific prospecting, diamond drilling, sampling, mine workings, mine evaluation, and mining terms, as well as others industrially and financially oriented.—GDC

05876 **Norton, James J.** Pegmatites of the southern Black Hills, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 187–189, 1968.

Pegmatites occur in an area of about 280 sq mi surrounding the Harney Peak Granite. The country rock is mostly quartz-mica and mica-schists of metasedimentary origin. The granite consists chiefly of quartz, albite, and perthitic microcline; muscovite is the most abundant accessory. Most of the approximately 20,000 pegmatites in the surrounding area are lithologically similar to the granite, and the difference is gradational between the crystal sizes; about 200 of the pegmatites are zoned. Potash feldspar is the chief mineral product of the pegmatites, although other minerals are mined also. Numerous mines and occurrences of pegmatites in the Keystone mining district are described.—HRC

00223 **Norton, Stephen A.** Origin of the Chester emery deposit, Chester, Massachusetts [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 44–45, 1969.

Nyman, Dale J. *See* Watkins, Frank A., Jr. 06088

06091 **Nyman, Dale J.; Watkins, Frank A., Jr.** Ground-water appraisal of the Big Blue River basin and Big Blue Reservoir site, Indiana, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V.2: U.S.Cong . . , 90th, 2d sess., Senate Doc. 96, p. 289–301, illus., table, 1968.

Supplies of ground water are available for farm, domestic, and small industrial and municipal supplies from: (1) Pleistocene sand and gravel—moderate to large; (2) Devonian and Silurian dolomite and limestone, and sands and gravels interbedded with Pleistocene till and silt—small to moderate; and (3) Devonian and Mississippian shale and Pleistocene till—small. Water from bedrock is of good chemical quality, with total dissolved solids usually less than 400 ppm; at depths greater than 250 feet below the top of the rock, the water is generally not potable. Water from sand and gravel is also of good quality and contains total dissolved solids ranging from about 300–500 ppm.—MCM

06092 **Nyman, Dale J.; Watkins, Frank A., Jr.** Ground-water appraisal of the Flatrock River basin and Downeyville Reservoir site, Indiana, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V. 2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 303–314, illus., table, 1968.

Adequate supplies for farm, domestic, small municipal, and industrial uses are available almost everywhere in the basin except at the city of Columbus. Sources of small to moderate supplies are Devonian dolomites, Silurian limestones, and sand and gravel interbedded with till and silt of Recent and Pleistocene ages. Quaternary sand and gravel north of Rushville and north of Columbus are potential sources of large supplies. Sand and gravel in buried bedrock valleys would be a source of moderate to large amount, if thick and areally extensive. Water from sand and gravel is of good chemical quality, with total dissolved solids ranging from about 300 to 500 ppm; water from bedrock has total dissolved solids usually less than 500 ppm.—MCM

00224 **Oldale, Robert N.** Subsurface geology of the southeast coast of Massachusetts [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 45, 1969.

Olson, A.Peter. *See* Rummerfield, Ben F.06142

00225 **Olsson, Richard K.** Paleocene planktonic foraminiferal biostratigraphy of New Jersey [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 45–46, 1969.

00226 **Ondrick, Charles W.; Griffiths, John C.** Petrographic and geochemical quantification of the Rensselaer Graywacke, Troy, New York [abs.]: Geol. Soc. America Abs.with Programs 1969, pt. 1, Northeastern Sec., p. 46, 1969.

O'Neill, M. *See* Bolt, Bruce. 06327

05898 **Opdyke, N. D.** The paleomagnetism of oceanic cores, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 61–70, illus., table;discussion, p. 70–72, 1968.

Correspondence of the sequences of normally and reversely magnetized sections of oceanic cores with the magnetic stratigraphy of lava flows based on K–Ar ages reflects the control exerted by the change of polarity of the Earth's magnetic field. Radiolarian zones and the magnetic stratigraphy exhibit the same time dependence. These correlations, together with other paleomagnetic parameters, serve as guides to the Plio–Pleistocene stratigraphy of oceanic sediments, rates of sedimentation, and the history of the Earth's magnetic field.—MS

Orville, Philip M. *See* New England Intercoll. Geol. Conf. 05939

00227 **Osberg, Philip H.** Equilibrium considerations in Buchan-type metamorphic rocks, south-central Maine [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec.,p. 46–47, 1969.

Osler, J. C. *See* Golder, H. Q. 06071

05925 **Ostrom, John H.; Quarrier, Sidney S.** The Rocky Hill dinosaurs, Trip C–3 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 12 p., paged separately, illus., 1968.

Tracks that occur in gray arkose and shale in the East Berlin Formation are best preserved in the arkose where the bedding is better preserved. More than 1,000 footprints have been studied and identified and more remain. Three and possibly four species have been identified; they are, in decreasing abundance: *Eubrontes giganteus, Anchisauripus sillimani*,and *Batrachopus dispar*. The first two were bipedal forms, the latter quadripedal. A few possible tracks of *Grallator cuneatus* have been recognized also. No skeletal remains are known from Rocky Hill, but a discussion of the possibilities and probabilities is included. The trails appear to be completely randomly oriented.—HRC

Otto, J. B. *See* Burke, W. H. 00075

05956 **Overman, A. R.; Peverly, J. H.; Miller, R. J.** Hydraulic conductivity measurements with a pressure transducer: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 884–886, illus., 1968.

A rapid method for measuring hydraulic conductivities of materials in the range 10^{-6} to 10^{-10} cm/sec is described. By using a pressure transducer as part of a decreasing head permeameter, the time constant for measurement is reduced. Only small volume transfers of water are required. An example [kaolinite] is discussed to illustrate the method.—Authors' abstract

Oxburgh, E. R. *See* Turcotte, D. L. 06332

06160 **Ozol, Michael A.** Performance of foliated rocks in concrete [abs.]: Virginia Jour. Sci., v. 19, no. 3, p. 194, 1968.

00228 **Palmer, A. R.** Stratigraphic evidence for magnitude of movement on the Champlain thrust [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 47–48, 1969.

Palmer, K. R. *See* Dawson-Grove, G. E. 05947

06350 **Pariseau, William G.; Dahl, H. Douglas.** Mine subsidence and model analysis: Soc. Mining Engineers Trans., v. 241, no. 4, p. 488–494, illus., 1968.

Recent legislation infers that engineers can predict and control surface damage caused by mine subsidence. In fact, practically no such ability appears to exist. As the middle ground between the empiricism of measurement and the theoretical abstractions of idealized media, particular attention is focused on rational selection and use of laboratory models. In field data cited casually without regard for the mining system being used, it is surprising how similar subsidence action can be in quite dissimilar situations. The deformation in direct relationship to mining activity is of major importance in subsidence, not the nature of the overburden. A pilot experimental study to model mine subsidence correctly has produced results in qualitative agreement with field observations.—GDC

00148 **Park, David E., Jr.; Croneis, Carey.** Origin of Caballos and Arkansas Novaculite formations: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 94–111, illus., table, 1969.

The Caballos and Arkansas Novaculite formations are thick, areally extensive cherts characterized by massive white "novaculite" chert; they have common depositional features and variable bedding and coloration. Laboratory studies show that the chert is composed of close-fitting quartz blocks 1–10μ in size. Small-scale depositional features, well-preserved fossils, and beds with sapropelic material are present. The chert and novaculite formed from organically precipitated silica particles in the 1–10μ size range, which accumulated below wave base where little detrital material was deposited and where current action was infrequent. In diagenesis, selective solution and redeposition on crystallization centers formed close-fitting blocks. The unusual thickness of siliceous rocks is partly due to the long-time span (at least the Devonian Period) during which these formations were deposited.—*from* Authors' abstract

Park, Richard A. *See* Porter, Leonard A. 00164

00229 **Parker, Garald G.** Geology and urbanization [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 48, 1969.

Parker, P. L. *See* Mauer, Larry G. 06341

05931 **Parks, George A.; Akhtar, Salim.** Magnetic moment of Fe^{2+} in paramagnetic minerals: Am. Mineralogist, v. 53, nos. 3–4, p. 406–415, illus., tables, 1968.

The effective magnetic moment of Fe^{2+} in monoclinic pyroxenes, orthorhombic pyroxenes, cordierite, amphibole, biotite, wolframite and sphalerite calculated from susceptibility data is found to be a variable with values spanning the theoretical range from 4.90 to 6.70 Bohr magnetons. Interpretation of this variability in terms of site symmetry is explored and found incomplete.—Authors' abstract

06162 **Parsons, R. W.** Unit mobility ratio displacement front passing a circular permeability discontinuity: Soc. Petroleum Engineers Jour., v. 8, no. 4, p. 347–350, illus., 1968.

When a displacement front encounters an isolated permeability heterogeneity, it will be perturbed. The details of this perturbation will depend on the heterogeneity size and shape, the permeability contrast, and the mobility ratio. This paper deals with the displacement front behavior for one, simple, mathematically tractable model: a circular permeability discontinuity and unit mobility ratio. The progress of an initially planar front is shown for four permeability contrasts: k_2/k_1 = 0, 1/2, 2, infinity. The front distortion is more pronounced than streamline and

isopotential distortion and it approaches a constant shape downstream from the discontinuity.—Author's abstract

Pattee, Eldon C. *See* Harrison, Jack E. 00123

Patterson, O. F., 3d. *See* Baird, Donald. 06033

06344 **Patterson, T. N. L.** Escape of atmospheric helium by nonthermal processes: Rev. Geophysics, v. 6, no. 4, p. 553–557, 1968.

Several nonthermal mechanisms have been proposed to resolve the discrepancy between the rate at which helium is released from the Earth's crust and the average rate of thermal escape of the gas. The various mechanisms [activation by an electric field, metastable helium reactions with atomic oxygen, magnetic field variations, ionic processes, escape through polar ionosphere] are examined critically. Loss of its ions from the polar ionosphere appears to be the most likely mechanism controlling the escape of helium.—Author's abstract

06005 **Pearl, Richard Howard.** Quaternary geology of the Morrison quadrangle, Colorado: Mtn. Geologist, v. 5, no. 4, p. 197–206, illus., 1968.

During the Quaternary there were three pre–Bull Lake pediments, Bull Lake and Pinedale strath terraces, and two Holocene alluvial deposits formed in the Morrison quadrangle. From oldest to youngest,they are: Rocky Flats Alluvium and pediment of Nebraskan and possible Aftonian age; Verdos alluvium and pediment of Kansan and possible Yarmouth age;Slocum Alluvium and pediment of Illinoian and possible Sangamon age; Bull Lake Louviers Alluvium and terrace; Pinedale Broadway Alluvium and terrace; Piney Creek Alluvium of middle Holocene age; and post–Piney Creek alluvium of late Holocene age. Along the mountain front above the Rocky Flats pediment are truncated spurs, which are believed to have formed in the late Pliocene or early Pleistocene.—*from* Author's abstract

06045 **Pease, Maurice H., Jr.; Peper, John D.** The Brimfield(?) and Paxton(?) formations in northeastern Connecticut, Trip F–5 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 18 p., paged separately, illus., 1968.

A field trip forty miles long, with ten stops in the Eastford–Westford area, is presented. The purpose of the trip is to examine a sequence of rocks that are contiguous with strata in Massachusetts mapped as Brimfield Schist and Paxton Quartz Schist. Recent mapping shows that the contacts mapped earlier are incorrect and that the Brimfield()) Schist overlies the Paxton(?) Quartz Schist in a structurally complex but rightside–up homoclinal sequence northwest of the Eastford fault, and that the Brimfield(?) rocks have been thrust southeastward over the Paxton(?) on the Black Pond fault. Faults of unknown displacement may have caused repetitions or gaps in the section, and relationships with adjacent rock units await further mapping. The Brimfield and the Paxton are older than the Middle Devonian.—HRC

06072 **Pedersen, Roger J.; Schenk, Hilbert.** Application of the resistance–capacitance heat flow analog to soil systems [with French abs.]: Canadian Geotech. Jour., v. 5, no. 4, p. 181–191, illus., 1968.

An electrical analog of two–dimensional heat transfer systems, easily constructed of small resistors and capacitors, has many uses in the study of heat transfer in soils. Scale factors are established and a 146–node model is applied to the design of a pit to be used for inserting thermistor probes laterally into a soil mass. The model is also used to obtain general solution maps to other soil systems with results displayed on generalized graphs of *equivalent depths*. This graphical approach, explained herein, is useful for illustrating the effect of local anomalies in two dimensional soil systems having sinusoidal surface temperatures. Limitations of this simple analog model are discussed.—Authors' abstract

05941 **Peoples, Joe Webb.** A brief history of geology in Connecticut, *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, p. x–xv, illus., 1968.

The first geological work in Connecticut was by J. G. Percival, beginning in 1835; from 1842 to 1879 very little was done aside from incidental reports. The U.S. Geological Survey was active from 1879 to 1903, and the State Geological and Natural History Survey has been in existence since 1903. In 1948, great emphasis was placed upon the detailed quadrangle mapping of the State; this was expanded to a cooperative program with the U.S. Geological Survey in 1955. Also in 1955 a provisional geological map was published and a revision is currently being planned. Uranium-bearing minerals from the State were among the first to be age-dated because of the quality of the analyses given for them. Between 1911 and 1917, considerable cooperative work with the U.S. Geological Survey was carried out for ground water resources.—HRC

Peper, John D. *See* Pease, Maurice H., Jr. 06045

06305 **Perret, William R.** Shear waves from a nuclear explosion in a salt cavity: Seismol. Soc. America Bull., v. 58, no. 6, p. 2043–2051, illus., tables, 1968.

Shear waves from the Sterling event, a nuclear explosion the cavity left by the Salmon detonation in the Tatum salt dome, were strongest in records of vertical motion at stations in the shot-level plane, but were detectable in records from both vertical and horizontal radial gages above and below that elevation; none could be identified in records from shot-level gages oriented horizontally. All instruments were within the salt dome between 166 and 660 m from the explosive source. Shear waves carried over 95 percent of the energy in vertical shot-level records, but less than 11 percent of the energy in horizontal radial shot-level records. The vertically polarized shear wave probably is caused by vertical asymmetry at the source.—*from* Author's abstract

05942 **Pessl, Fred, Jr.; Schafer, J. P.** Two-till problem in Naugatuck-Torrington area, western Connecticut, Trip B-1 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 25 p., paged separately, illus., 1968.

Two texturally and structurally distinct tills which rest on crystalline rocks are studied. They are investigated in great detail petrographically and it is shown that the lower till was deposited by glacial ice flowing from the north and northwest. Oxidation depth and staining suggest that the lower till was deeply weathered before the upper till was deposited. There is also an erosional contact between the two. Late during the deposition of the upper till the ice-flow direction changed toward the east; the upper till may include subglacial and supraglacial facies. Nine specific stops to see the various till features in detail are described.—HRC

05934 **Petersen, G. W.; Cunningham, R. L.; Matelski, R. P.** Moisture characteristics of Pennsylvania soils—[Pt.] 2, Soil factors affecting moisture retention within a textural class, silt loam: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 866–870, illus., tables, 1968.

In this laboratory study, effort was made to hold an individual texture constant while scrutinizing the influence of other soil properties upon soil moisture. Available moisture was generally highest in the A, less in the B, and lowest in the C horizon; moisture retention reflected more the coarse fragment content than horizon development features. Nonfragic horizons retained almost twice as much moisture as did fragic horizons. Moisture retention decreases as coarse fragments increase, so calculations for them should be corrected. Available moisture remained almost constant as organic matter increased within silt loams. Weight percentage contents of clay minerals were not significantly correlated with moisture retention. The 20–5μ silt seems the most important <2 mm size-separate control at field capacity.—*from* Authors' abstract

00171 **Peterson, Robert.** Progressive failure in slopes of overconsolidated plastic clay and clay shales—Discussion [of paper 5456 by L. Bjerrum, 1967]: Am. Soc. Civil Engineers Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 336–337, illus., 1969.

The writer cannot recall any slides that cannot be explained by Bjerrum's hypothesis (ibid., v. 93, no. SM 5, pt. 1, p. 1–49) based on recoverable strain energy. In a short term laboratory test on hard unweathered shale, strong bonds restricted swelling, while *in situ* the bonds were destroyed by weathering and differential strain. Behavior illustrated for the Bearpaw Shale indicates the water contents along the laboratory curve are significantly lower than the field curve at equivalent pressure.—ESL

Peverly, J. H. *See* Overman, A. R. 05956

00174 **Philbrick, Shailer S.** Classification and identification of shales—Discussion [of paper 5560 by L. B. Underwood, 1967]: Am. Soc. Civil Engineers Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 348–349, 1969.

During classification and identification, shale should be treated as a rock which has properties and characteristics related to its site. This may involve maps and sections so that the shale becomes important geologically as well as from the engineering standpoint. Some of the difficulties with such a classification are presented, especially in the case of "rock-like" shales in the Pennsylvanian of the Ohio Valley, which were distinguished by grain size. The name subshale is proposed for "soil-like" shales.—ESL

05884 **Phinney, Robert A.** (editor). The history of the Earth's crust, a symposium—Goddard Inst. Space Studies,1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, 244 p., illus., tables, 1968.

The results of a two-day conference held at the Goddard Institute for Space Studies in New York in November 1966 are reported in this compilation of papers. These, together with solicited papers, are cited separately under the individual authors.—MS

05885 **Phinney, Robert A.** Introduction, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966 Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 3–12, 1968.

The history and premises of theories relating to crustal development from introduction of the concept of isostasy to the "revolutionary" hypothesis of sea-floor spreading associated with convection in the mantle are outlined. General objections to the continental drift theory are evaluated in the light of new evidence of sea-floor spreading; the evidence for sea-floor spreading supplied by the magnetic-reversal time scale is noted.—MS

05945 **Pickett, G. R.; Reynolds, E. B.** Evaluation of fractured reservoirs [abs.], *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. C1–C2, 1968.

06112 **Pierce, W. G.** Tectonic denudation as exemplified by the Heart Mountain fault, Wyoming, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 3, Orogenic belts: Prague, Academia, p. 191–197, illus., 1968.

The Heart Mountain fault, on the east side of the Rocky Mountain front in northwest Wyoming, produced a surface of tectonic denudation over 50 km in length. The fault, which extends for 100 km in the direction of movement, had horizontal movement of the frontal beds of about 50 km. Although the slope on which movement took place is very low, movement of the upper plate and the tectonic denudation accompanying it must have been extremely rapid. Near the close of early Eocene, 450 to 750 m of strata, mostly Paleozoic carbonates, were tectonically removed. Immediately after denudation, volcanic rocks blanketed the area and entombed the denuded surfaces.—*from* Author's abstract

05866 **Pitkin, James A.** Airborne measurements of terrestrial radioactivity as an aid to geologic mapping: U.S. Geol. Survey Prof. Paper 516-F, p. F1-F29, illus., tables, 1968.

Airborne measurements of terrestrial gamma radioactivity (aeroradioactivity) have been interpreted by correlation with areal geology. Data from surveying of 200,000 sq mi in the conterminous United States and Puerto Rico show that correlations made between patterns of aeroradioactivity and geology are an aid to geologic mapping. Examples of correlation are discussed within a general framework of physiographic provinces. The aeroradioactivity data were obtained with scintillation detection equipment installed in a twin-engine aircraft and included a multi-crystal array. Corrections were made for cosmic and aircraft background and for variations from the 500-ft terrain clearance elevation. The airborne surveys were made on behalf of the U.S. Atomic Energy Commission to establish background datum levels of environmental radioactivity around nuclear facilities.—JAP

06117 **Plaster, Rodger W.; Sherwood, W. Cullen.** Geochemistry of three central Virginia soils [abs.]: Virginia Jour. Sci., v. 19, no. 3, p. 194, 1968.

00230 **Platt, Lucian B.** Taconic events in the Hamburg 15′ quadrangle, Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 48-49, 1969.

06334 **Podio, A. L.; Gregory, A.R.; Gray, K. E.** Dynamic properties of dry and water-saturated Green River shale under stress: Soc. Petroleum Engineers Jour., v. 8, no. 4, p. 389-404, illus., 1968.

Dynamic elastic properties of dry and water-saturated Green River shale samples were computed from compressional- and shear-wave velocity measurements made in three directions mutually perpendicular to bedding planes, and in several different directions by varying the angle between bedding planes and direction of wave propagation for angles of 0, 30, 45, 60, and 90°. Oriented samples were subjected to confining pressure and axial loads in excess of confining stress, in the direction of propagation. P- and S-wave velocities increased with increasing stress levels, with corresponding increase in Young's modulus. Water saturation caused P-wave velocity to increase and S-wave velocity to decrease. Elastic moduli decreased upon saturation except for Poisson's ratio. The samples showed a moderate degree of anisotropy, expected from the laminated nature and shallow occurrence of the shale.—*from* Authors' abstract

00080 **Polhemus, Robert W.** Optical viewing aids for submersibles: Marine Technology Soc. Jour., v. 3, no. 1, p. 83-88, illus., tables, 1969.

Some recent deep submersibles have been provided with optical viewing aids. To help the submersible user select an optical viewing aid, and keeping in mind both scientific and military missions, the design of these viewers is discussed from the use and application standpoint, rather than the optical design involved. Included in the discussion are: advantages and disadvantages of each design; some approaches to more optimum optical aids; consideration for improvements in pressure-sphere window design; and a systems approach to specifying such optical aids.—Author's abstract

06175 **Pollack, Henry N.** On the interpretation of state vectors and local transformation operators, *in* Computer applications in the earth sciences—Colloquium on simulation: Kansas Geol. Survey Computer Contr. 22, p. 36-46, illus., tables, 1968.

Krumbein (1967) states that an important by-product of Markov chain experiments is that the scientist comes to view his observations as a set of states that succeed each other in some patterned way, and that this pattern, if discovered, can lead to a fuller understanding of the underlying geologic process. This paper focuses on the origin, characteristics, and interpretation of a small group of patterns of succession. By exploring the links between state vectors, local transformation operators, and associated differential equations, attention is drawn to the vital transition zone where assemblages of observations become identifiable as states of

some process. Probing this zone will hopefully enable the science of geology to advance from a state of statistical characterization to one of deterministic prediction.—ESL

Pollard, David D. *See* McIntyre, Donald B. 06177

Poorooshasb, H. B. *See* Eden, W. J. 06070

00164 **Porter, Leonard A.; Park, Richard A.** Biofacies analysis of the Middle Trenton (Ordovician) of New York State [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 49, 1969.

Poskitt, Trevor J. *See* Barden, Laing. 00159

Potter, Paul Edwin. *See* Blakely, Robert F. 06134

06098 **Potter, R. R.** (editor). Geological investigations in New Brunswick: New Brunswick Dept.Nat. Resources Mineral Resources Br. Inf. Circ. 68-1, 31 p., illus., tables, 1968.

Most of the projects outlined in this progress report were initiated in 1966 and are part of a long term program of geological investigations in stratigraphic and structural studies, compilation of existing data on metallic and industrial mineral occurrences, mapping and sampling in many areas of interest, and geochemical and ground water surveys. More comprehensive accounts will be published in the near future.—MCM

06099 **Potter, R. R.** (compiler). List of publications available from Mineral Resources Branch, Department of Natural Resources: New Brunswick Dept. Nat. Resources Mineral Resources Br. Inf. Circ. 68-2, 36 p., illus., 1968.

Publications of the Mineral Resources Branch include geological maps, information circulars, map series, mineral resources reports, papers, reports of investigations, and reproductions.—MCM

05965 **Protz, R.; Riecken, F. F.** Profile distribution of nonexchangeable Mg in the $<1\mu$ clay in seven loess-derived soils: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 861-865, illus., tables, 1968.

The nonexchangeable Mg content of the $<1\mu$ clay in seven loess-derived soils [of Iowa and Missouri], representing a wide range of soil development, decreases with depth. A direct relationship exists between the nonexchangeable Mg content of the $<1\mu$ clay and exchangeable Mg/g of $<2\mu$ clay. An inverse relationship is present between nonexchangeable Mg in the $<1\mu$ clay and exchangeable H/g of $<2\mu$ clay. The montmorillonite/kaolinite ratio increases sharply with depth to 50 cm, below which the ratio remains constant. It is concluded that Mg has not been built into the clay fraction during soil profile development.—Authors' abstract

05995 **Prucha, John James.** Sedimentary rock deformation related to structure in the basement [abs.]: Corpus Christi Geol. Soc. Bull., v. 9, no. 2, p. 5, 8, 1968.

06012 **Prucha, John James.** Salt deformation and decollement in the Firtree Point anticline of central New York: Tectonophysics, v. 6, no. 4, p. 273-299, illus., table, 1968.

A detailed study was made at Myers, N.Y., of deformation of Salina Group rock salt, folded with less ductile dolomites and shales on the Firtree Point anticline. The anticline is a composite feature with numerous small-scale doubly plunging disharmonic folds of amplitudes to 30 m and wave lengths to 100 m which reveal progressive change in mode from flexural-slip folding controlled by competent dolomite to passive folding controlled by salt. "The change in deformation mode followed obliteration of structural integrity and competence of dolomite interbeds which failed on extension fractures when individual flexural-slip folds reached a critical radius of curvature." On the basis of 0.53 kbar confining pressure and

temperature of 77°C at the time of folding, the yield strength of salt was less than 100 kg per cm^2.—VSN

00079 **Pruna, Andres; Mairs, Robert L.** Panoramic reconstruction of the sea floor environment, using underwater photography, direct observations, and field sketches: Marine Technology Soc. Jour., v. 3, no. 1, p. 73–78, illus., 1969.

Graphic illustration by a scientifically trained artist provides a panoramic view of the sea floor unobtainable directly by photography. Detailed photographs, direct observations, and field sketches are combined to produce a photographically documented hypsographic reconstruction of the sea floor. Dry submersible or diver traverses show only a sequence of closeup photographs because of the visibility limitations presented by the ocean environment. At present large scale aspects of the topography are best developed from direct observations. Underwater photographs arranged in traverse sequence serve to refresh the memory and provide topographic, geologic, and biologic detail. The resulting detailed illustration gives a three-dimensional composite panorama of the sea floor. This combined artist-photographic technique has been applied to submarine cable routing, habitat emplacement, and geological and biological reconnaissance.—Authors' abstract

00064 **Puffett, Willard P.** The Reany Creek Formation, Marquette County, Michigan: U.S. Geol. Survey Bull. 1274–F, p. F1–F25, illus., 1969.

The Reany Creek Formation crops out in the northeastern part of the Dead River basin, Marquette County, Mich., and consists of a basal conglomerate, a middle sequence of graywacke and slate containing disrupted beds of arkose and dispersed boulders of granitic rocks, and an upper unit of arkose, quartzite, slaty graywacke, and conglomerate; maximum thickness is 3,000–3,500 feet. The middle sequence is similar to other formations in the Lake Superior region believed to be of glacial origin. The formation is presumed to be of middle Precambrian age as it is intruded by Keweenawan dikes and rests unconformably on lower Precambrian greenstones; it is tentatively correlated with the Gowganda Formation of Canada.—WPP

Pytkowicz, Ricardo M. *See* Kester, Dana R. 06119

Qamar, A. *See* Bolt, Bruce. 06327

Quarrier, Sidney S. *See* Ostrom, John H. 05925

Quarrier, Sidney S. *See* Bannerman, Harold M. 06046

05918 **Rackley, R. I.; Shockey, P. N.; Dahill, M. P.** Concepts and methods of uranium exploration, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 115–124, illus., 1968.

A granitic source for the uranium is preferred because it eliminates the need for external sources and avoids some problems of transportation. The events which take place at the leading edges of geochemical cells, or in the solution front, are examined. Granites are the source of the uranium, or at least the principal sources. Burial is required to protect the hydrodynamic system, and tectonism is required to form the geochemical cell. Cell growth follows, and then the biochemical reactions begin. Metal zoning is described as is the geometry of the cell. Examples from the Gas Hills and Crooks Gap area of central Wyoming are cited.—HRC

06065 **Radbruch, Dorothy H.** Engineering geology in urban planning and construction in the United States, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 12, Engineering geology in country planning: Prague, Academia, p. 105–111, 1968.

Most of the needs for urban geologic information are met by large organizations such as the Federal and State geological surveys and the universities. In the United States, geologic factors have only recently been recognized as being important in long-range urban planning and in preparation of zoning and construction ordinances. The greatest use of geology in urban planning and construction in the

United States is in California, where metropolitan growth is extremely rapid and geologic problems are widespread and acute.—KAF

Raymond, G. P. *See* Walker, L. K. 06058

00067 **Reed, John C., Jr.** Ancient lavas in Shenandoah National Park near Luray, Virginia: U.S. Geol. Survey Bull. 1265, 43 p., illus., geol. map, 1969.

The Catoctin Formation is a thick sequence of greenstone and associated sedimentary rocks of late Precambrian(?) age. Primary texture structures are especially well preserved in the greenstone in Shenandoah National Park. These features show that the greenstones are metamorphosed basalt lava flows. The original lavas were erupted on land and were probably normal plateau basalts.—JCR

Reed, John C., Jr. *See* Love, J. D. 05987

Reichl, F. E. *See* Jeffries, F. 06343

Reilly, Edgar M., Jr. *See* Fisher, Donald W. 00273

06093 **Renick, Abbott.** Louisville Reservoir site, Clay and Effingham Counties, Illinois—Mineral survey report, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V. 2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 315–330, illus., tables, 1968.

Surficial material in the vicinity of the Louisville Reservoir consists primarily of Illinoian drift. Pennsylvanian rocks (part of the Mattoon Formation of the McLeansboro Group) that underlie the unconsolidated deposits are shales and sandstones with occasional thin coal beds generally less than three feet thick and limestone beds generally less than 15 feet thick. Continued operation of oil wells in the reservoir area would be feasible with precautionary measures. Deposits of coal are present, but depth of the beds under the reservoir site (950–1,100 feet) makes them uneconomic at present. Current mining of limestone in an adjacent area could be a source of aggregate for construction purposes.—MCM

06094 **Renick, Abbott.** Helm Reservoir site, Marion County, Illinois—Mineral survey report, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V. 2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 331–342, illus., tables, 1968.

Pennsylvanian rocks of the Mattoon Formation, McLeansboro Group, underlie Pleistocene and recent unconsolidated rocks throughout the area of the proposed damsite and reservoir; outcrops of bedrock are scarce. The Pleistocene is relatively thin, and local outcrops of sandstone and shales are common along streams. Although production from the Iuka oil pool has been declining, it is recommended that it should be maintained for the maximum feasible period. Deposits of coal are undoubtedly present under the reservoir site, but beds are too deep to be exploited.—MCM

Renick, Abbott. *See* Heising, Leonard F. 06095

06096 **Renick, Abbott.** Big Blue Reservoir site, Hancock, Rush, and Shelby Counties, Indiana—Mineral survey report, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V. 2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 351–358, illus., table, 1968.

The proposed Big Blue project is located in the Tipton Till Plain, which is characterized by broad, flat uplands between U-shaped valleys. The Big Blue River's valley floor is covered by glacial drift composed of sandy silty clay intermixed with some gravel. Bedrock is principally Devonian limestones and dolomites which are underlain by Silurian limestone and shales. Limestone, and sand and gravel, the only known mineral deposits on the proposed reservoir site, are of relatively low value and occur over broad areas in the vicinity.—MCM

06097 **Renick, Abbott.** Downeyville Reservoir site, Rush and Decatur Counties, Indiana—Mineral survey report, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V.2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 359–368, illus., table, 1968.

The Downeyville Reservoir site along the Flatrock and Little Flatrock Rivers lies near the northern edge of the Muscatatuck physiographic unit. The gently rolling topography is largely controlled by the underlying Devonian and Silurian bedrock surface. Glacial drift cover is from 15 to 25 feet thick at two quarry sites. Dolomitic limestones suitable for rubble, veneer stone, aggregates, and agricultural limestone are the only known mineral commodities produced along the rivers at the reservoir site; two such quarries would be flooded for the reservoir construction.—MCM

00140 **Rex, R. W.; Syers, J.K.; Jackson, M.L.; Clayton, R. N.** Eolian origin of quartz in soils of Hawaiian Islands and in the Pacific pelagic sediments: Science, v. 163, no. 3864, p. 277–279, illus., tables, 1969.

The particle-size distribution and oxygen-isotopic composition of quartz isolated from Hawaiian soils, east-central Pacific sediments, and tropospheric dusts are remarkably uniform. A common origin and tropospheric transport from continental land masses is suggested.—Authors' abstract

Reynolds, E. B. *See* Pickett, G. R. 05945

00057 **Reynolds, J. H.** [Comments on discussions of "Plutonium-244 in the early solar system . . ." by D. D. Sabu and P. K. Kuroda (1967)]: Nature, v. 218, no. 5182, p. 729, 1969.

Reynolds continues to be critical of certain details of Kuroda's analysis (ibid., p. 726–729), particularly in regard to his calculation of the fission component in various meteorites because of presumed contamination by atmospheric xenon. He also disagrees that there is a real difference between methods of calculating $^{129}Xe_{radiogenic}$ (method of Sabu and Kuroda) and the method of Sabu, Ganapathy, and Kuroda. It can be shown that both expressions are identical.—VSN

05989 **Reynolds, J. H.** Plutonium-244 in the early solar system [discussion of paper by D. D. Sabu and P. K. Kuroda (1967)]: Nature, v. 218, no. 5146, p. 1024–1028, illus., table, 1968.

Agreements between plutonium-244/xenon and iodine-129/xenon decay intervals for achondritic meteorites could confirm the suggestion (Sabu and Kuroda, ibid., v. 216, no. 5114, p. 442–446, 1967) that these two extinct radioactivities were synthesized in the galactic nucleosynthesis process. Reynolds points out errors in Sabu and Kuroda's calculations and indicates that the methods applied to achondrites are too rough to merit the conclusion that there is concordancy between the I-Xe and Pu-Xe methods of dating achondrites.—VSN

Reynolds, Mitchell W. *See* Harrison, Jack E. 00123

06048 **Rhoads, Donald C.; Berner, Robert A.** Animal-sediment relationships and early sediment diagenesis in Long Island Sound, Trip E-1 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 11 p., paged separately, illus., table, 1968.

The purpose of the trip, apparently by vessel is to (1) sample and observe sedimentologic features that are important limiting factors in the distribution of bottom dwelling organisms, (2) offer a new hypothesis for explaining the spatial separation of filter feeding and deposit feeding communities, (3) describe how animal-sediment relationships observed in Long Island Sound would be preserved in the fossil record, and (4) characterize the chemical environment within the sediments and some of the changes taking place as a result of early diagenesis.—*from* Authors' introduction

Richard, Benjamin H. *See* Kuenzi, W. David. 00103

Richards, Francis A. *See* Adams, Donald D. 05985

00190 **Rickard, Lawrence V.** Stratigraphy of the Salina Group and origin of its salt beds [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 49–50, 1969.

Riecken, F. F. *See* Protz, R. 05965

00121 **Rigby, J. Keith.** A new Middle Cambrian hexactinellid sponge from western Utah: Jour. Paleontology, v. 43, no. 1, p. 125–128, illus., 1969.

A new genus and species of lyssakid sponge, *Ratcliffespongia perforata*, are proposed and described from a single Middle Cambrian specimen from western Utah [House Range]. The sponge is conico-cylindrical with large elliptical parietal openings which pierce a thin, loose-textured wall composed of irregularly oriented coarse stauract spicules of at least three sizes. Oscular and basal regions are unknown because of the fragmental nature of the specimen.—Author's abstract

06153 **Rigby, J. Keith.** Guide to the geology and scenery of Spanish Fork Canyon along U.S. Highways 50 and 6 through the southern Wasatch Mountains, Utah—Studies for students, No. 2: Brigham Young Univ. Geology Studies, v. 15, pt. 3, 31 p., illus., 1968.

Spanish Fork Canyon cuts across 25,000 feet of Pennsylvanian to Tertiary sedimentary rocks in its course from Soldier Summit to its mouth. The outcrops document part of the Laramide orogeny in the Wasatch Mountains, their erosion, and deposition of the sediments in many forms and directions. Coarse gravels now form the massive conglomerate cliffs of Red Narrows. Mesozoic formations record cyclic invasions of the sea and periods of alluvial and eolian deposition of great thickness. Abundantly fossiliferous sediments deposited in early Tertiary lakes are now elevated in the Green and Flagstaff Formations of the high plateaus, cut by canyons of today. In this guidebook, generalized sections, sketches and photographs illustrate features to be seen, including landslide masses, tilted slump blocks, fans, terraces, fault zones, and various types of valleys.—GDC

Rigby, J. Keith. *See* Hamblin, W. Kenneth. 06154

06157 **Rigby, J. Keith; Hintze, Lehi F.** Guide to the geology of the Wasatch Mountain Front, between Provo Canyon and Y Mountain, northeast of Provo, Utah—Studies for students, No. 1: Brigham Young Univ. Geology Studies, v. 15, pt. 2, 29 p., illus., 1968.

The interplay of geologic processes responsible for the landscape of this region includes: faulting in which there was vertical displacement of thousands of feet, erosion of the uplifted mountain mass, and deposition of the sediments to over a mile thick in the valley occupied intermittently by the extensive Ice-Age Lake Bonneville. Most striking evidences of the lake's Pleistocene levels are many high terraces on the valley walls, above the large flat delta and later terraces of the Provo River. Generalized sketches and photographs illustrate the features to be seen on the field trip; details are pointed out in the road log. A geologic column presents the Precambrian to Permian rock formations exposed in the Wasatch Mountains near Provo.—GDC

06136 **Rigo, Richard J.** Middle and Upper Cambrian stratigraphy in the autochthon and allochthon of northern Utah: Brigham Young Univ. Geology Studies, v. 15, pt. 1, p. 31–66, illus., table, 1968.

Strata of this age in the Ogden Canyon autochthon include Ophir Shale, Maxfield Limestone, Calls Fort Shale Member of the Bloomington Formation, Nounan Dolomite, and St. Charles Formation; four fossil collections permit regional correlation to southwestern Wyoming. Cambrian rocks in Ogden Canyon are overlain conformably by Ordovician rocks not previously recognized. In the allochthon of the Blacksmith Fork area, the succession is Langston Formation, Ute

Formation, Blacksmith Dolomite, Bloomington Formation, Nounan Dolomite, and St. Charles Formation. Facies changes, shown in five measured sections, differ north and south of Blacksmith Fork, indicating seven major eastward transgressions and six major westward regressions of the Cambrian sea. The root zone of this allochthon is in the Promontory Range; the allochthon has been thrust 40 to 60 miles east of its original position.—GDC

06055 **Rimsaite, J.** Geochemistry, mineralogy and petrology of poly-mica rocks, *in* Internat. Geol. Cong., 23d, Prague, 1968, Proc., Sec. 6, Geochemistry: Prague, Academia, p. 45–66, illus., tables, 1968.

Geochemical, mineralogical and petrological studies of biotite–muucovite and polymica rocks are reported. It is concluded that: (1) a close relationship exists between mica type and conditions of crystallization; (2) coexisting phlogopite–biotite and biotite–muscovite pairs are stable under rare favorable conditions, the earlier-crystallized mica usually alters or recrystallizes during crystallization of the late mica; (3) the late mica is more stable during post–crystallizational alteration than the early mica; (4) the compositional range of biotite that coexists with muscovite is narrow, being wider in biotites from metamorphic rocks than that in biotites from magmatic rocks; and (5) muscovite remains stable during crystallization of sericite under hydrothermal and low–metamorphic conditions, whereas biotite alters along with associated plagioclase.—*from* Author's abstract

06164 **Rinehart Oil News Company.** Ira Rinehart's reference book—Jurassic exploration, east Texas: [Dallas, Tex.] Rinehart Oil News Co., p. B1–B128, looseleaf, illus., 1968.

For 64 Jurassic fields in eastern Texas, the following information is given: location, discovery, average elevation, net pay, formation record, spacing rule, gravity of condensate, principal leaseholders, and development history. A map of each field and an electric log (if released) accompany the descriptions.—MCM

06130 **Ritzma, Howard R.** Black gold in Utah's Circle Cliffs?: Utah Geol. and Mineralog. Survey Quart. Rev., v. 2, no. 4, p. 4–5, 1968.

Field work has outlined two large deposits of oil-impregnated sandstone in the Moenkopi, and two small ones in the Shinarump Member of the Chinle. Both Moenkopi deposits are stratigraphic accumulations with some structural control on one. All deposits contain an asphalt base oil, and it is estimated that the two large deposits contain 500 million to 1 billion bbls of oil in place. The Circle Cliffs anticline, 60 mi long and 20 mi wide, has been explored by only two wells. Below the Kaibab Limestone, exposed on the crest, lie 6,000 feet of Paleozoic strata; the flanks and gentle plunges to the north and south are considered prime areas for oil entrapment.—ESL

00191 **Riva, John.** Canajoharie and Utica in eastern North America [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 50, 1969.

00192 **Roberts, Francis H.** Retrograde metamorphism of ultramafic rocks along the Precambrian axis of southeastern Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 51, 1969.

Roberts, W. L. *See* Lingard, Amos L. 05877

Robertson, W. A. *See* Irving, E. 00070

Robertson, W. A. *See* Irving, E. 05891

Robinson, Alfred E. *See* Seaber, Paul R. 00199

05994 **Robinson, Peter.** *Talpavus* and *Entomolestes* (Insectivora, Adapisoricidae): Am. Mus. Novitates, no. 2339, 7 p., illus., table, 1968.

Entomolestes grangeri and *Talpavus nitidus* are considered to be two different members of the family Adapisoricidae. Because of the morphology of the molars

and the reduction of the anterior dentition, *E. grangeri* is considered a possible ancestor of the Soricidae; it is also considered a possible ancestor of the Erinaceidae. *T. nitidus* is considered to be related to more general adapisoricids.—KAF

Rodda, Peter U. *See* Fisher, W. L. 00132

05924 **Rodgers, John.** General geology of the Triassic rocks of central and southern Connecticut, Trip C–2 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 9 p., paged separately, 1968.

This is the road log for a trip of about 82 miles, beginning and ending in New Haven. Ten stops are made, each described in detail in other portions of the guidebook.—HRC

05937 **Rodgers, John.** General geology of the Triassic rocks of central and southern Connecticut, Trip C–2 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 2 p. (C–O), paged separately, 1968.

Triassic rocks of the Connecticut valley fill a large half-graben in Connecticut and Massachusetts; their present outcrop is an area of 103 by 21 miles and they are typical of the half-graben deposits exposed from Nova Scotia to South Carolina. The true thickness cannot be determined because the fault was discontinuous in time and at places was overlapped by sediments before becoming reactivated. Red beds predominate, ranging from fanglomerates to red siltstone and silty shale; some sandstone, conglomerate, argillite, and coal also occur. All of the material is continental, either lacustrine, paludal, or fluviatile. Basaltic lavas, three in Connecticut, are interlayered in the rocks. Fossils are rare but sufficient to identify the rocks at Late Triassic. Radiometrically, the rocks are 225 m.y.—HRC

Roed, Murray A. *See* Gabert, G. M. 06331

Rohr, David M. *See* Bowman, John R. 06158

Rokach, Allan. *See* Newman, Walter S. 00236

00115 **Rollins, Harold B.** The taxonomic position of *Cyrtonella mitella* (Hall) (Mollusca, Monoplacophora): Jour. Paleontology, v. 43, no. 1, p. 136–140, illus., 1969.

New information on muscle arrangement suggests that *Cyrtonella* Hall be placed in the Cyrtolitinae. A comparison of cyrtolitinid muscle patterns shows that most of the coiled cyclomyans have a standardized muscle pattern consisting of a strong dorsal pair and a variable number of subsidiary pairs extending laterally and ventrally and forming a muscle "ring". The subfamily Cyrtonellopsinae (Horný, 1965) is rejected because the muscle scars of *Cyrtonellopsis* are as yet unknown and because, in other features, this genus closely resembles *Cyrtonella*.—JWH

00137 **Rona, E.; Emiliani, C.** Absolute dating of Caribbean cores P 6304–8 and P 6304–9: Science, v. 163, no. 3862, p. 66–68, illus., tables, 1969.

Two deep-sea cores from the central Caribbean have been dated by the Th-230/Pa-231 method. The ages obtained are in agreement with the ages previously obtained from other deep-sea cores from the same area. Because of their greater precision, the new dates provide a more accurate time scale for the past 170,000 years. Authors' abstract

00193 **Rona, Peter A.** Lower continental rise hills off Cape Hatteras [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 51–52, 1969.

Ross, David A. *See* Emery, K. O. 06338

Rowe, Gilbert T. *See* Menzies, Robert J. 06132

00176 **Rowe, P. W.; Barden, Laing.** Drained strength characteristics of sands—Discussion [of paper 5561 by K. L. Lee and H. B. Seed, 1967]: Am. Soc. Civil Engineers Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 353–359, illus., 1969.

The work of Casagrande, referred to by Lee and Seed (ibid., v. 93, no. SM 6, p. 17–19) is discussed. The writers applied the Rowe equation to a sand element at any point on a stress path; three conditions are listed at which there is danger of confusion between "constant volume" and "critical void ratio."—ESL

05979 **Rowland, Richards A.** Memorial of Otto Charles von Schlichten (July 19, 1886–October 4, 1950): Am. Mineralogist, v. 53, nos. 3–4, p. 599–601, portrait, 1968.

00063 **Różkowska, A. D.; Różkowski, A.** Seasonal changes of slough and lake water chemistry in southern Saskatchewan (Canada): Jour. Hydrology, v. 7, no. 1, p. 1–13, illus., tables, 1969.

Detailed hydrochemical studies of lakes and sloughs in the Moose Mountain area of southern Saskatchewan showed an increase of the water salinity and the enrichment of waters with easily soluble salts during the summer season. This increase was accompanied by precipitation of the poorly soluble salts. The salinity and chemistry of the large lakes varied less than that of the smaller sloughs. The highly mineralized, shallow sloughs, located in deep kettles, showed increases of salinity during summer of 200 to 300 percent and particularly a sharp rise of sulphate and magnesium ions.—Authors' abstract

Różkowski, A. *See* Różkowska, A. D. 00063

Rucker, James B. *See* Cheetham, Alan H. 00108

00194 **Rumble, Douglas, 3d.** Stratigraphy of the Orfordville Formation in the Mount Cube area, western New Hampshire–eastern Vermont [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 52, 1969.

06142 **Rummerfield, Ben F.; Olson, A. Peter; Hoover, D. B.** Seismic survey in the region of recent earthquake activity near Denver, Colorado: Geophysics, v. 33, no. 6, p. 915–925, illus., 1968.

A seismic-reflection survey was carried out near Denver, Colo., to determine if structures exist in the 12,000-ft sedimentary section or in Precambrian basement that might explain the recent earthquake activity. No major faults were revealed in the sedimentary section. Reflections from a steeply dipping horizon believed to be in the basement complex may be indicative of faulting; however, the magnitude cannot be ascertained, as reflection events cannot be correlated at these depths. The results of the survey suggest the possibility of monitoring and studying subsurface structural conditions and related parameters in regions of seismic activity and(or) suspected zones of tectonic instability.—*from* Authors' abstract

05912 **Runge, John S.** Exploration for "Dakota" oil traps, Black Hills area, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 79–82, illus., 1968.

Significant oil and gas reserves are known to exist in a variety of stratigraphic traps. Large areas of similar stratigraphic conditions in the Dakota are known to exist at shallow to moderate depths around the Black Hills uplift. Low drilling cost and high oil recoveries from Dakota stratigraphic traps make exploration attractive to those with venture capital. The greatest reward will come to those who analyze the rocks and the associated fluids in detail and who make exploration investments on the basis of logical interpretations.—Author's conclusions

06076 **Rush, F. Eugene.** Geology and ground-water resources of Burlington County, New Jersey: New Jersey Div. Water Policy and Supply Spec. Rept. 26, 65 p., illus., tables, geol. map, 1968.

Burlington County lying between Trenton, Atlantic City, and Camden, with an area of 827 sq mi, is in the Atlantic Coastal Plain physiographic province. New industries and additional population have increased water usage; 26 mgd of ground water were used in 1960. The Raritan and Magothy Formations are the most prolific producers, but Cohansey Sand and Kirkwood Formation have a great and, as yet, untapped potential; small to moderately large supplies have been obtained from other aquifers. Maximum average potential recharge to ground-water reservoirs is estimated to be about 790 mgd; presently most of it is rejected because the aquifers are essentially full. Although ground-water supplies are considered sufficient for the foreseeable future, well spacing must be planned to avoid local overdevelopment.—*from* Author's abstract

06140 **Rushforth, Samuel R.; Tidwell, William D.** Notes on the distribution and morphology of the fern genus *Astralopteris*: Brigham Young Univ. Geology Studies, v. 15, pt. 1, p. 109–113, illus., 1968.

The Cretaceous fern genus *Astralopteris*, previously reported from the Dakota Sandstone of Utah and Colorado, has been uncovered at two additional localities: one in the Dakota Sandstone in northeastern Arizona, the second in the younger Frontier Formation of Wyoming. Specimens of *Astralopteris* from these localities have contributed additional information on the soriation of this genus. Sori of *Astralopteris* have been found to be indusiate with each sorus containing from 17 to 21 sporangia arranged in a circle around a central placenta. Sporangia are annulate, with vertical annulus. A costal aerole has been observed in both fertile and sterile pinnules. Veinlets arising from this aerole and from the major secondary veins converge beneath the sori.—*from* Authori' abstract

Russ, John C. *See* Kimoto, Shiwuo. 00053

Ryder, R. B. *See* Wilson, W. E. 05944

05904 **Sales, John K.** Regional tectonic setting and mechanics of origin of the Black Hills uplift, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 10–27, illus., 1968.

Laramide and post-Laramide deformation is a mechanically integrated system, the Pacific block having been driven east under the craton; the Benioff megathrust transmitted stress through the Cordilleran geosyncline. The difference between the Canadian, United States, and Central American segments is the manner and degree of resistance by the crust east of the Cordillera. Most of the uplifts of the Wyoming province are crustal drag folds and overlapping, tilted slabs. The Lewis and Clark lineament has acted as a transcurrent fault. The configuration of foreland deformation, model studies, and apparent transmission of tangential stress through the craton suggest that the crust is acting as a rigid, semi-elastic slab; model experiments suggest that Berg's fold-thrust configuration of major block-bounding structures is correct.—HRC

06060 **Samson, L.** Discussion [of] Settlement observation at Kars ridge by W. J. Eden and H. B. Pooroosbasb (v. 5, no. 1:28–45) [1968]: Canadian Geotech. Jour., v. 5, no. 4, p. 245–248, illus., table, 1968.

To add to this field case, the writer presents briefly some of his experience on pore pressure dissipation in a sensitive soft clay subjected to loadings exceeding the preconsolidation pressure of the clay. The field case illustrated concerns a temporary preloading fill located at Berthierville, 30 mi northeast of Montreal, Quebec.—ESL

06062 **Samson, L.** [Discussion of "Settlement of a furnace foundation, Sorel, Quebec" by H. Q. Golder and J. C. Osler (v. 5, no. 1: 46–56) 1968]: Canadian Geotech. Jour., v. 5, no. 4, p. 250, 1968.

Laboratory data available to the writer show that the deep-seated Leda clay in this area is slightly over consolidated.—ESL

Sanders, John E. *See* Longwell, Chester R. 00084

00195 **Sanders, John E.** Syndepositional deformational structures at sand/mud interfaces [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 52–53, 1969.

05926 **Sanders, John E.** Stratigraphy and structure of the Triassic strata of the Gaillard graben, south-central Conn. [summ.], Trip C–4 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol.Conf., 60th Ann.Mtg., New Haven, Conn., 1968: Connecticut Geol.and Nat. History Survey Guidebook 2, 1 p., paged separately, 1968.

06002 **Sanders, John E.** Stratigraphy and structure of the metamorphic rocks of the Stony Creek antiform . . . [summ.], Trip F–3 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 1 p., paged separately, 1968.

Sandidge, John R. *See* Brent, Millard D. 00065

Santos, Gabriel. *See* Uken, Ernst A. 06181

00074 **Sasajima, Sadao; Maenaka, Kazuaki.** Variation of the geomagnetic field intensity since the late Miocene: Jour. Geophys. Research, v. 74, no. 4, p. 1037–1051, illus., tables, 1969.

To estimate the variation of the geomagnetic field intensity since the late Miocene, the Thelliers stepwise heating method has been applied to a series of Neogene to Quaternary volcanic rocks taken from the Kuju volcanic region of Kyushu Island, west Japan. As a result we can conclude broadly that the geomagnetic field has generally increased in intensity from the late Miocene to the present, with fairly large and long-term fluctuations. It seems likely that the intensity of the geomagnetic field and its variation during the past 1 m.y. have not significantly differed from the intensity and variation for the past several thousand years. Authors' abstract

00196 **Saunders, R. S.; Smith, Norman D.** Environmental control of acritarchs in the Silurian of eastern Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 53, 1969.

Savage, J. C. *See* Clee, T. E. 00062

Scalf, Marion R. *See* Keeley, Jack W. 00055

Schafer, J. P. *See* Pessl, Fred, Jr. 05942

05943 **Schafer, J. P.** Periglacial features and pre-Wisconsin weathered rock in the Oxford-Waterbury-Thomaston area, western Connecticut, Trip B–2 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 5 p., illus., 1968.

Five field trip stops are made to examine different aspects of periglacial frost features. Involutions, occurring as deformation of eolian material, ice-wedge and frost-crack structures, clastic dikes, and periglacial colluvial and solifluction zones are to be seen; each is described where seen.—HRC

00197 **Schamel, Steven.** Microscopic configuration of slaty and fracture cleavage [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 53–54, 1969.

Schenk, Hilbert. *See* Pedersen, Roger J. 06072

00157 **Schiffman, Robert L.; Chen, Albert T-F.; Jordan, Jane C.** An analysis of consolidation theories: Am. Soc. Civil Engineers Proc., v. 95, paper 6370, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 285–312, illus., 1969.

The one–, pseudo three–, and three–dimensional theories of consolidation are analyzed. The problem of a strip load on a half–plane is solved for the complete stress field. The Mandel–Cryer effect is noted and analyzed in terms of its physical motivation and influence on failure conditions. Attention is drawn to lateral distribution of excess pore pressure and maximum shear stress. The effect of pore pressure spreading is noted. The three–dimensional pseudo theory is not a good approximation to three–dimensional consolidation. An analysis of thick layers is made. Predictions of progress of consolidation by three–dimensional theory are about an order of magnitude faster than by conventional theory; three–dimensional theory models the consolidation process better than other comparable theories. Field experience should be developed to enable interpretation of this theory.—*from* Authors' abstract

06038 **Schleh, E. E.** Some general problems in regional stratigraphic integration of Mississippian strata in the Cordilleran region: Mtn. Geologist, v. 5, no. 4, p. 181–186, 1968.

Although much more remains to be learned about the Mississippian System in the Cordilleran region, it is not too early to attempt regional stratigraphic syntheses. Nevertheless, the regional stratigrapher must guard against blindly accepting the unwarranted assumptions of earlier workers, even though such ideas may be strongly entrenched in the literature. This paper is a plea to the regional stratigrapher to exercise a critical examination of the facts upon which regional interpretations ultimately must rest.—Author's conclusions

06151 **Schmidt–Collerus, Josef J.; Hollingshead, Robert D.** Investigations into the nature of dawsonite in the Green River formations, *in* Fifth symposium on oil shale: Colorado School Mines Quart., v. 63, no. 4, p. 143–167, illus., tables, 1968.

Colorado oil shale samples from a drill core from Rio Blanco County, Colo., containing from 10 to 12 percent dawsonite, were used to characterize the latter by thermal analysis and to investigate the possibility of an alternate method of analysis for this mineral in oil shale. During the concentration and separation of dawsonite from the oil shale by density gradient centrifugation, two fractions were obtained which show notable differences in physical properties and thermal behavior and could point to the possible presence of two different aluminum carbonate minerals in the core sample. An analytical procedure, based on the combination of differential thermal analysis with GLC methods was developed and found satisfactory for certain dawsonite samples.—*from* Authors' abstract

05980 **Schmitt, H. H.** Memorial of Harrison Ashley Schmitt (June 11, 1896–October 26, 1966): Am. Mineralogist, v. 53, nos. 3–4, p. 601–608, portrait, 1968.

Schmoll, Henry R. *See* Dobrovolny, Ernest. 06064

00198 **Schneider, William J.** Water for the cities—The outlook [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 54–55, 1969.

00142 **Scholl, David W.; Craighead, Frank C., Sr.; Stuiver, Minze.** Florida submergence curve revised—Its relation to coastal sedimentation rates: Science, v. 163, no. 3867, p. 562–564, illus., 1969.

New data substantiate as well as modify the south Florida submergence curve, which indicates that eustatic sea level has risen continuously, although at a generally decreasing rate, during the last 6500 to 7000 sidereal years (5500 standard radiocarbon years) to reach its present position. Accumulation rates of coastal deposits are similar to the rate of sea–level rise, thus supporting the generalization that submergence rates largely determine as well as limit rates of coastal sedimentation in lagoonal and estuarine areas.—Authors' abstract

06122 **Scholl, David W.; Buffington, Edwin C.; Hopkins, David M.** Geologic history of the continental margin of North America in the Bering Sea: Marine Geology, v. 6, no. 4, p. 297–330, illus., 1968.

The North American Bering Sea continental margin has three geomorphic provinces: a southeastern, with gentle continental slope and no V-shaped canyons, and an outlying continental borderland; a central, with steep canyon-scarred slope; and a northwestern, with gentler, less eroded slope. Seismic profiles show three major structural-stratigraphic units: acoustic basement under outer shelf and upper slope; overlying main-layered-sequence; and a stratified rise unit under and forming the continental rise and base of the slope. The margin evolved with downbowing and faulting of the basement in early Tertiary and concomitant overdraping of 1500 m of the main-layered-sequence strata; intense canyon cutting began in late Tertiary and Quaternary. Subsidence may be related to oceanization of a continental block, or isostatic depression of a segment of the Pacific Ocean floor.—*from* Authors' abstract

Schooner, Richard. *See* Bannerman, Harold M. 06046

05867 **Schopf, Thomas J. M.** Atlantic continental shelf and slope of the United States—Nineteenth century exploration: U.S. Geol. Survey Prof. Paper 529-F, p. F1–F12, illus., table, 1968.

Two periods of exploration are prominent. The first (1807–1870) was characterized by initial broad surveys of bathymetry and of sediments, especially through the efforts of F. R. Hassler, J. W. Bailey, and L. F. de Pourtalès. The second period (1871–87) was dominated by biological investigations. A. E. Verrill was foremost among those who described the offshore fauna (especially the thousands of specimens of invertebrates) collected by the newly formed U.S. Fish Commission. Correct interpretations of the origin of sediments and of faunal provinces were seriously hampered by an insufficient understanding of glaciology. Offshore bedrock geology was correctly surmised from rocks dredged by fishermen. Water studies were the least advanced of these pioneer investigations because reversing thermometers were not introduced until 1878, and drift bottles were not used on a large scale.—TJS

05906 **Schrayer, G. J.; Zarrella, W. M.** Organic carbon in the Mowry Formation and its relation to the occurrence of petroleum in Lower Cretaceous reservoir rocks, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 35–39, illus., tables, 1968.

Regional mapping of the average organic content of the Mowry Shale suggested that important Lower Cretaceous oil accumulations might be found in northeastern Wyoming and/or southeastern Montana. The prediction has been convincingly verified by recent discoveries of large accumulations of petroleum in the Muddy Sandstone of both areas.—*from* Authors' conclusions

Schreiber, Edward. *See* Anderson, Orson L. 06109

00086 **Schumm, Stanley A.** River metamorphosis: Am. Soc. Civil Engineers Proc., v. 95, paper 6352, Jour. Hydraulics Div., no. HY 1, p. 255–273, illus., tables, 1969.

Data collected from stable alluvial rivers on the Great Plains of the western United States, and on the Riverine Plain of southeastern Australia are used to demonstrate that channel width, depth, shape, meander wavelength, sinuosity and gradient are significantly related to the quantity of water and to the type of sediment load moving through these channels (ratio of bed-material load to total sediment load). Frequently during geologic time, complete alteration of river morphology (river metamorphosis) has occurred as a result of climate changes, whereas during historic time river metamorphosis occurs as a result of man-induced variations of hydrologic regimen. Geologic and historic examples of river metamorphosis are used to support the empirical relations and to form the basis for deductions concerning the long-term reaction of a river system to man-induced changes of hydrologic regimen.—Editor's abstract

06172 **Schwarzacher, Walther.** Experiments with variable sedimentation rates, *in* Computer applications in the earth sciences—Colloquium on simulation: Kansas Geol. Survey Computer Contr. 22, p. 19–21, illus., 1968.

Due to the complexity of natural processes, little has been learned about the mechanics of sedimentation from attempts to simulate stratigraphic sequences. A limited problem, "How do fluctuating sedimentation rates affect the manner in which geologic processes are recorded in the stratigraphic column?", is studied using a composite section of Pennsylvanian rocks of Kansas. The constant sedimentation rate model was of limited use; it is more realistic to assume that sedimentation rates are in themselves random variables. The application of variable sedimentation rate models is described. The thickness distribution of different beds has not been examined yet, but can also be simulated with the model.—ESL

05991 **Scientific American.** Readings in the Earth sciences, V. 1–2 (Offprints 801–874): San Francisco, Calif., W. H. Freeman and Co., 622 p., illus., tables, 1968.

Scientific American Offprint Series, reprints of magazine articles, were initiated in response to requests from teachers in secondary schools and colleges for material for classroom use. These two volumes contain 74 articles arranged according to topics: origin, composition, and evolution of the Earth; Earth materials, features, forces, processes; oceans, atmosphere, weather and climate; time and evolution of life; and the Antarctic. Author and topic indexes are included in each volume.—MCM

00073 **Sclater, J. G.; Corry, C. E.; Vacquier, V.** In situ measurement of the thermal conductivity of ocean-floor sediments: Jour. Geophys. Research, v. 74, no. 4, p. 1070–1081, illus., tables, 1969.

Twenty-eight measurements of thermal conductivity of ocean-floor sediments have been made in place by means of a temperature gradient probe. For 12 different locations the mean of the difference between the in situ value and the conductivity determination at the same depth on a gravity core was 0.02×10^{-3} cal per cm sec °C. The 4 percent increase in conductivity in the second meter and the 9 percent error at the 95 percent confidence limit gives a combined error associated with the in situ measurement that is smaller by a factor of 2 to 3 than other environmental errors affecting heat-flow measurement. These results suggest that, when the Bullard type probe is used, no core need be taken, thus saving about 30 percent of ship time. The in situ probe has the additional advantage that it will often return a measurement when the sediment is impenetrable by a piston or gravity core.—*from* Authors' abstract

Scott, J. C. *See* Turner, J. D. 06084

Scott, J. C. *See* McWilliams, R. G. 06085

Scott, J. S. *See* Brooker, E. W. 06063

00199 **Seaber, Paul R.; Robinson, Alfred E.** Conjunctive use of ground and surface water in eastern urban areas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 55, 1969.

00152 **Searles, Leonard C.** Memorial, Thomas Yancey Ramsey (1910–1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 188, portrait, 1969.

00163 **Seed, H. Bolton; Idriss, Izzat M.** Influence of soil conditions on ground motions during earthquakes: Am. Soc. Civil Engineers Proc., v. 95, paper 6347, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 99–137, illus., tables, 1969.

Data are presented to show that in many cases characteristics of ground surface motions during earthquakes, and corresponding forms of response spectra, vary with soil conditions in a reasonably predictable way. A method of analysis, based on knowledge of shear moduli and damping factors of soil strata, values of which are strain-dependent, is presented. Behavior observed during small earthquakes does not necessarily indicate behavior of the same soil during a large earthquake. In

any analysis it is important to ensure compatibility of soil characteristics with magnitude of induced strains. Characteristics of ground motions at the surface of a soil are greatly influenced by magnitude and epicentral distance of the earthquake. For many sites, appropriate analyses can provide a useful guide in evaluating characteristics of surface motions likely to be induced by earthquakes.—*from* Editors' abstract

06024 **Seiglie, George A.** Bibliografía sobre los foraminíferos bentónicos recientes la provincia Caribe-Antillana, con observaciones: Asoc. Venezolana Geología Minería y Petróleo Bol. Inf., v. 11, no. 1, p. 5-15, 1968.

A bibliographic list of publications on Recent benthonic Foraminifera in the Caribbean-Antilles area is presented. Following a general section, the 127 entries are divided by areas: Central America; Brazil; Gulf Coast of the United States; Cuba; Florida, Bahamas, and the southeastern coast of the United States; Gulf of California; Jamaica; Gulf Coast of Mexico; Puerto Rico; Trinidad and other Lesser Antilles; and Venezuela.—ESL

06349 **Seiglie, George A.** Relationships between the distribution of *Amphistegina* and the submerged Pleistocene reefs off western Puerto Rico: Tulane Studies Geology, v. 6, no. 4, p. 139-147, illus., tables, 1968.

More than 100 samples were taken from Holocene and Pleistocene reef sediments in an area of about 12 by 11 km. Pleistocene reef remnants submerged to 80 m depth and a wave-cut terrace at 55 m depth were found with five echo-sounding profiles. Three main foraminiferal reef assemblages exist today in the Caribbean region: the *Amphistegina-Archaias* fauna in the warm waters of the Antilles (including study area), and two *Amphistegina* (without *Archaias*) faunas, one in the Gulf of Mexico, the other off eastern Venezuela, in less warm waters. The submerged Pleistocene reefs are correlated with those in the Gulf of Mexico and off Barbados. The highest percentages of *Amphistegina gibbosa*, both Pleistocene and modern, are associated with the position of submerged Pleistocene reefs in these areas.—VMJ

06146 **Sendlein, Lyle V. A.** Discussion on "Refraction determination of water table depth and alluvium thickness" by James Otto Duguid (Geophysics, June 1968, p. 481-488): Geophysics, v. 33, no. 6, p. 1019-1020, illus., 1968.

Sendlein questions three points in Duguid's paper [ibid., v. 33, no. 3, 1968]: (1) the method of determining velocities from the time-distance curve, (2) the reliability of the velocities determined, and (3) the interpretation of the time-distance curve for one particular station. Duguid's rather random method of velocity determination from points on the time-distance plot would seem to render the seismic refraction method ineffective in areas of inadequate borehole control. He should have collected enough data so that at least four points could be used to determine a slope on a time-distance curve.—DBV

06336 **Sergiades, A. O.** Silver cobalt calcite vein deposits of Ontario: Ontario Dept. Mines Mineral Resources Circ. 10, 498 p., illus., tables, 1968.

Silver-cobalt-calcite vein deposits of Ontario are described individually. Four card sheets or two pages that include references and statistics are used for producing and past producing mines, two card sheets or one page for some past producing mines and developed prospects. Minor prospects, 10 to a page, are described briefly. For a few prospects in the Cobalt area neither silver nor cobalt have been recorded in published literature but because development work was considerable, these have been included. The format is experimental and intended to facilitate searching of information. Modification is desirable regarding ages of rocks where some duplication is present. Districts, townships, and deposits are arranged alphabetically; index maps show locations of deposits; complete listing of properties is given for most areas; and the index is cross referenced.—*from* Author's abstract

00078 **Shaefer, George V.** Geologic considerations for the emplacement of Sealab II: Marine Technology Soc. Jour., v. 3, no. 1, p. 25-28, illus., tables, 1969.

Studies conducted at the Sealab I site off Bermuda proved man could survive in the hostile marine environment. The "Man-in-the-Sea" program of the U.S. Navy selected the site location for Sealab II on the south flank of Scripps Canyon at a water depth of 205 feet. A sediment sampling program collected several samples that were analyzed for engineering properties, primarily sediment bearing capabilities, and for standard grain size determinations. Results indicated sediments in the vicinity of the site were very fine sands capable of supporting a load of approximately 560 p.s.f. After emplacement of Sealab II, settling measurements made during the 45-day period it remained on the sea floor indicated all settling occurred soon after impact with the bottom. As future manned habitats go deeper, geologic character of the sea floor must be determined to safeguard these laboratories.—*from* Author's abstract

06087 **Shamburger, Victor M., Jr.** Geologic map of Pike County, Alabama: Alabama Geol. Survey Map 72, scale about 1 in. to 2 mi., text, 1968.

Units of sedimentary origin that crop out in Pike County are, from oldest to youngest: Cretaceous Ripley Formation and Providence Sand of the Selma Group; Tertiary Clayton and Nanafalia Formations and Tuscahoma Sand; and Quaternary terrace and alluvial deposits. Faulting has occurred in the western section and local deformation of Clayton and Nanafalia Formation beds is common to the south. Large quantities of water for most uses can be obtained from the Cretaceous and Tertiary formations. Resources of economic value are brown iron ore in the Clayton Formation, clay from Cretaceous and Tertiary formations, lignite in the Nanafalia, and sand and gravel in outcrops and terrace deposits along major streams.—MCM

05875 **Shapiro, L. H.; Gries, J. P.** Ore deposits in Paleozoic rocks, northern Black Hills, South Dakota, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 179-185, illus., 1968.

A review of the Paleozoic section in the region is followed by a brief description of different types of mineralization found in different mining districts in the Black Hills area: Bald Mountain (gold-silver), Carbonate (lead-silver; gold-silver-lead-manganese), Galena (lead-silver), Garden-Maitland (gold-silver), Lead (gold-silver-tungsten), Ragged Top (gold), Spruce Gulch (gold-lead-zinc), Squaw Creek (gold), and the Two Bit (gold-silver).—HRC

05933 **Sharma, M. L.; Uehara, G.** Influence of soil structure on water relations in Low Humic Latosols—[Pt.] 1, Water retention; [Pt.] 2, Water movement: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 765-774, illus., 1968.

Experiments were carried out to study the effect of two aspects of soil structure, macrofabric and microfabric, on water retention and water movement in two latosolic soils (Molokai and Wahiawa series, Oahu) of Hawaii, similar in composition but different in structure. Moisture retention curves of soils and their water-stable aggregates indicate that, for strongly structured soils, the macrofabric had great influence in tension range 0 to 0.3 bar, beyond which the microfabric had more effect. Influence of microfabric was also demonstrated by applying surface tension, radius of curvature, pressure relationship on selected aggregate fractions. Capillary conductivity results showed macrofabric effect more pronounced in low-tension range, 0-0.2 bar; identical flow rates for the same size water-stable aggregates of both soils suggest no significant intraped pore contribution. Microfabric might influence fluid flow in the high tension range.—GDC

Shen, C. K. *See* Lee, Kenneth L. 00162

00091 **Sherman, G. Donald; Ikawa, Haruyoshi; Matsusaka, Yoshito.** Aluminous-ferruginous oxide mineral nodules in tropical soils: Pacific Sci., v. 23, no. 1, p. 115-122, illus., tables, 1969.

Secondary oxide mineral nodules occur in the ferruginous, ferruginous bauxitic, and bauxitic soils of the Hawaiian Islands. The concentration of these oxide nodule aggregates which are larger than 2 mm ranges from 5 percent in some ferruginous

soils to as high as 85 percent in the ferruginous bauxitic soils of the Halii family. The nodules are formed by the process of induration in which the hydrated amorphous hydroxide and oxides are dehydrated to their crystalline oxide form. The resulting indurated oxide nodule becomes an independent unit in the soil system with corresponding loss of effective surface even though the nodule may contain friable clay material in its interior. The typical nodule produced in the ferruginous bauxitic soil has a dense iron oxide layer (hematite and maghemite) and, in the interior, soft to hard, lighter-colored material which contains gibbsite.—Authors' abstract

Sherwood, W. Cullen. *See* Plaster, Rodger W. 06117

06178 **Shibata, Ken; Ishihara, Shunso.** K-Ar ages on biotite from Questa Mine area, New Mexico, U.S.A. [with Japanese abs.]: Japan Geol. Survey Bull., v. 19, no. 4, p. 247–250, illus., tables, 1968.

K-Ar ages of 21 and 23 m.y. are reported for biotite samples in a vein of the main Questa molybdenum deposit and from the Z-tunnel mine dump of the Log Cabin prospect, respectively. These early Miocene ages agree with field observations.—VSN

06105 **Shigley, C. M.** Sea water as a raw material, *in* Mineral resources of the world ocean—Symposium, Newport, R.I., 1968, Proc.: Rhode Island Univ. Graduate School Oceanography Occasional Pub. 4, p. 45–50, illus., tables, 1968.

The ocean is the largest continuous ore body ever exploited by man, and the only one being replenished at a rate exceeding its consumption. Sea water contains inorganic ions of Cl, Na, Mg, S, Ca, K, Br, C, Sr, B, Si, and F, in amounts >1 ppm, and many others in lesser amounts. Ratios of the major components are relatively constant, but their absolute values vary locally owing to dilution and stratification, especially near the shore where most mineral extraction is done. Only sodium chloride, bromine, magnesium, and fresh water are being recovered on a large scale. Extraction processes used on the West Coast and in the Gulf of Mexico are outlined. Recovery of the other components will probably depend upon new desalination and ion-exchange techniques and advances in biochemistry.—VMJ

Shockey, P. N. *See* Rackley, R. I. 05918

05936 **Siebert, Harry L.** Engineering geology as applied to highway construction, Trip B-4 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 8 p., paged separately, illus., 1968.

Nine stops are made in which various aspects of highway geology are outlined. Relations between foliation and cut angles, joint intersections, and faults are discussed, with the solutions explained.—HRC

Silver, Eli A. *See* Moore, George W. 06330

Simon, Jack A. *See* Willman, H. B. 06015

00200 **Simpson, Dale R.** Hornfels associated with Triassic diabase [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 55–56, 1969.

05969 **Simpson, Dale R.** Substitutions in apatite—[Pt.] 1, Potassium-bearing apatite: Am. Mineralogist, v. 53, nos. 3–4, p. 432–444, illus., tables, 1968.

Apatites with good crystallinity can be synthesized at about 100°C by the slow release of calcium from EDTA into a phosphate-bearing solution. All apatites formed by this method have an enlarged *a*. Analyses show some apatites to be deficient in calcium even when the alkali is summed with calcium; however, all apatites crystallized contained an excess of water. The enlarged *a* is principally accounted for by substitution of H_2O in the hydroxyl position. Substitution of H^+ for calcium is proposed on the basis of charge balance, lattice dimensions, and

density. Such substitution causes a reduction in both *a* and *c*. The proposed substitutions are related to conditions of formation.—Author's abstract

05971 **Sinkankas, John.** Classical mineral occurrences—[Pt.] 1, Geology and mineralogy of the Rutherford pegmatites, Amelia, Virginia: Am. Mineralogist, v. 53, nos. 3–4, p. 373–405, illus., 1968.

The No. 1 and No. 2 Rutherford pegmatites were restudied during the period 1958–1960 when new operations provided open cut exposures to greater depths, enabling a more detailed description of the internal structure and mineralogy to be made. The mineral assemblages form six distinct zonal units arranged symmetrically about a central system of vugs. During these recent operations 25 species were found; of these, chlorite, herderite, loellingite, pyrrhotite, and sphene are new for this locality.—MEM

Sirkin, Leslie A. *See* Connally, G. Gordon. 00275

05902 **Slaughter, A. L.** Homestake mine, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 157–171, illus., 1968.

Gold, with accompanying mineralization, is localized in the Homestake Formation in zones of cross folding which increased the permeability of the schist and thus provided access to the mineralizing solutions. Causes of ore deposition are probably more chemical than physical, as both types of the formation (sideroplesite and cummingtonite schists) are replaced equally well. The chemistry of the replacement, however, is not fully understood. Gold is associated with four mineralization stages and is later than any mineral with which it is associated; it could be interpreted also as being from the fourth stage only. The fourth stage is later than Tertiary dikes; it is most abundant in association with quartz, chlorite, and arsenopyrite of the first stage. The quartz is locally-derived and has traveled only a short distance. That all is Precambrian is improbable.—*from* Author's conclusions

06135 **Smith, Alan R.** Techniques for obtaining fabric data from coarse clastic sediments: Brigham Young Univ. Geology Studies, v. 15, pt. 1, p. 13–30, illus., 1968.

For more rapid and accurate analyses of coarse clastic sediments, three optical scanners exist which, by linkage with a computer, might be used to scan and digitize textural data recorded on photographs of an outcrop. Most expensive, the IBM 2281 film scanner is designed for use with the IBM 360 computer; photograph or thin section of rock is placed between a cathode ray tube and a photomultiplier tube. Most versatile, less expensive, and ready to provide a digitized scan, the point-counting Ameda System, with automated microscope stage, also uses a photomultiplier tube; an electronic circuit analyzes the light and accumulates results. Fraunhofer diffraction patterns, produced by optical data processing with laser light, can be used to determine rock fabric as well as relative size frequency; this is faster and least expensive, but, for reliable data, analyzing techniques need considerable refinement.—GDC

00100 **Smith, Bennett L.; Vogel, Thomas A.; Spence, William A.** Precambrian metaconglomerate mantling a granite dome at Plevna Lake in the Grenville Province of southeastern Ontario, Canada: Geol. Soc. America Bull., v. 80, no. 2, p. 297–301, illus., 1969.

Apparently anomalous field relationships between coarse metaconglomerate containing granitic clasts and underlying granite are clarified by evidence that: (1) while the clasts closely resemble the granite megascopically, modal analyses show that most of them are unrelated plutonic rocks, and (2) there is a mineralogically and texturally distinct margin of the granite that is interpreted as a chilled border.—Authors' abstract

Smith, J. V. *See* Bennett, J. M. 06307

00143 **Smith, John D.; Foster, John H.** Geomagnetic reversal in Brunhes normal polarity spoch: Science, v. 163, no. 3867, p. 365–367, illus., table, 1969.

The magnetic stratigraphy of seven cores of deep-sea sediment established the existence of a short interval of reversed polarity in the upper part of the Brunhes epoch of normal polarity. The reversed zone in the cores correlates well with paleontological boundaries and is named the Blake event. Its boundaries are estimated to be 108,000 and 114,000 years ago ±10 percent.—Authors' abstract

06152 **Smith, John Ward; Trudell, Laurence G.** Wyoming Corehole No. 1—A potential site for production of shale oil in place, *in* Fifth symposium on oil shale: Colorado School Mines Quart., v. 63, no. 4, p. 55–69, illus., tables, 1968.

Bureau of Mines Wyoming Corehole No. 1 drilled near Eden in Wyoming's Green River basin sampled Green River Formation oil shales representing a potential of 200 million barrels of oil per square mile. In general properties and gross mineralogy the sampled oil shales strongly resemble Mahogany-zone oil shales of Colorado and Utah. Alternating thin beds of tough, rich oil shale and brittle, lean oil shale at depths less than 700 feet may offer advantages to in-place shale oil production techniques, providing possible access to at least 100,000 barrels of shale oil per acre in an area greater than 100,000 acres.—Authors' abstract

Smith, Norman D. *See* Saunders, R. S. 00196

00201 **Smith, Norman D.** Downslope variations in stratification in the Tuscarora Quartzite (Silurian) of central Pennsylvania [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 56, 1969.

Smith, Roger. *See* McIntyre, Donald B. 06177

05935 **Smith, W. D. M.** Formation factor values in Western Canada reservoirs, *in* Formation evaluation symposium, 2d, Calgary, Alberta, 1968: [Calgary, Alberta] Canadian Well Logging Soc., p. B1–B10, illus., 1968.

Formation factor values are calculated from well logs and compared to available lab data and the Archie equation. Reasonably good agreement is found in sandstones and wherever carbonate lab samples have been subjected to pressure. The effects of overburden pressure on log derived formation factors is apparent on a group of coarse vugular dolomites found at various depths. Log derived formation factors are probably more realistic than lab data where high pressures are present in situ.—Author's abstract

Smith, William C. *See* Judd, James B. 06034

Snavely, P. D., Jr. *See* Tatsumoto, M. 00060

00087 **Sorey, Michael L.; Matlock, William G.** Evaporation from an ephemeral streambed: Am. Soc. Civil Engineers Proc., v. 95, paper 6368, Jour. Hydraulics Div., no. HY 1, p. 423–438, illus., tables, 1969.

[In the southwestern United States, most of the natural recharge to aquifers is from intermittent flow in stream channels in alluvial deposits.] Daily evaporation was measured for sands that dry without contact with a water table. Selected sands from an ephemeral streambed were packed in cylinders, wetted, and weighed to determine evaporation loss under field climatic conditions. In summer and early fall tests, first-day evaporation from the sands was less than half that from an adjacent Class A Weather Bureau pan. During the first week, evaporation rates for the sands were lower than those reported for irrigated soil. The maximum depth of drying during the three-week tests was less than one foot.—Editor's abstract

Spence, William A. *See* Smith, Bennett L. 00100

Spiess, Fred N. *See* Larson, Roger L. 00138

00202 **Stanley, Daniel K.; Fenner, Peter; Kelling, Gilbert; Swift, Donald J. P.** Underwater television as a tool for mapping the outer continental margin [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 56–57, 1969.

05921 **Stanley, Rolfe S.** Bedrock geology of western Connecticut, *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 5 p. (D–O), paged separately, illus., 1968.

A brief review is given of the stratigraphy and structures of western Connecticut. Two major strike belts are present which extend northward into western Massachusetts and Vermont, separated from each other by 'Cameron's line'. The western belt consists of metamorphosed Cambrian and Ordovician rocks of the miogeosynclinal facies of western New England and of Precambrian rocks in the Housatonic and Berkshire Highlands and the Fordham Gneiss to the southwest. The eastern belt between 'Cameron's line' and the central Triassic basin contains eugeosynclinal rocks stratigraphically equivalent to the Cambrian–Devonian series of eastern Vermont. Triassic rocks occur in Pomperaug and Cherry Brook Valleys and border crystalline rocks of western Connecticut on the east.—VSN

05998 **Stanley, Rolfe S.** Metamorphic geology of the Collinsville area, Trip D-4 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 17 p., paged separately, illus., table, 1968.

Five field trip stops for study of the structure and stratigraphy in southern Massachusetts and southeastern Vermont are described; emphasis is on a new interpretation of the stratigraphy of the region. The Straits Schist has been traced northward into the area and is found between rocks of the northeastward-trending folds to the west and the main part of the Goshen Schist and is therefore younger, not older, than the Hartland Group in Collinsville. The rocks outside of the gneiss domes, which lie in a N–S belt east of the highland masses, form a large east-facing nappe which is draped over the North Granby dome. The Straits Schist forms the trough of a synclinal nappe and the Collinsville Formation forms a portion of the anticlinal cores of two stacked nappes; the upper limb of the lower one forms the domes of western Connecticut.—HRC

Steen, W. J. *See* Hoggatt, R. E. 06340

05893 **Stehli, Francis G.** A paleoclimatic test of the hypothesis of an axial dipolar magnetic field, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 195–207, illus., tables, 1968.

Paleolatitudes determined on the basis of taxonomic diversity of Permian faunas show no agreement with those determined from paleomagnetic data derived from measurements based on the assumptions that paleomagnetic measurements are valid when extended to Permian rocks and that the magnetic field was dipolar and axial. If a nonaxial rather than an axial field is assumed, the incompatibilities of the two sets of data become resolved. The paleomagnetic data do not necessarily support polar wandering or continental drift.—MS

Stephens, E. V. *See* Zeller, H. D. 00158

05974 **Stevenson, John S.** Memorial of Richard Percival Devereux Graham (June 14, 1880–July 29, 1965): Am. Mineralogist, v. 53, nos. 3–4, p. 551–555, portrait, 1968.

00203 **Stout, James H.** Substitutional disorder and compositional changes in cordierite [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 57–58, 1969.

Stuiver, Minze. *See* Scholl, David W. 00142

06078 **Sutcliffe, H., Jr.; Joyner, B. F.** Test well exploration in the Myakka River basin area, Florida: Florida Div. Geology Inf. Circ. 56, 61 p., illus., tables, 1968.

In recent years, difficulties encountered in obtaining ground-water supplies with acceptable chemical characteristics in the Myakka River basin area led to the implementation of a test drilling program. Under this program, well drilling and data collection were executed in such a manner that all water-producing zones of the local aquifers, together with the quality and quantity of the water available, were effectively identified. A step-drilling method was utilized which allowed the collection of formation cuttings, water samples, and water-level data, from isolated zones in the well as drilling proceeded. The step-drilling procedure is described. The driller's logs, geophysical logs, and chemical quality of water tables are presented.—Authors' abstract

06127 **Sutton, John.** Development of the continental framework of the Atlantic: Geologists' Assoc. Proc., v. 79, pt. 3, p. 275–303, illus., tables, 1968.

The opening of the Atlantic since Mesozoic is a direct consequence of structural changes which began in late Precambrian. The main stages recorded in the continental framework of the present Atlantic are: development of a system of mobile belts in late Precambrian; stabilization of successive sections of this system accompanied by progressive restriction of plutonism and uplift of stabilized mobile belts and adjoining forelands, leading to a Triassic continent extending from Arctic to Antarctic; and introduction of basaltic magma with extensive dike swarms and continental lava piles within continents from Carboniferous onward with fragmentation of the continent and opening of the Atlantic in Cretaceous as new oceanic crust developed. Horizontal movements carried the crust and underlying mantle towards regions where active orogeny continued.—*from* Author's abstract

00204 **Sutton, Robert G.** Sedimentary structures and their environmental significance in the marine Catskill delta of New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 58, 1969.

06304 **Swain, F. M.; Bratt, J. M.; Kirkwood, Samuel.** Possible biochemical evolution of carbohydrates of some Paleozoic plants: Jour. Paleontology, v. 42, no. 4, p. 1078–1082, illus., table, 1968.

A variety of fossil plants from Devonian to Permian rocks of 10 localities in England and eastern North America were analyzed for residual carbohydrates. There seems to be little if any difference in the carbohydrate components of the psilophytes and lycopods studied and those of modern pteridophytes. The greater quantity of D-galactose in fossil Equisetales than in modern examples suggests a change from important amounts of galactan structural polysaccharides to mainly glucans (such as cellulose) in modern *Equisetum*. An evolutionary change in the gymnosperm *Cordaites* between Devonian and Pennsylvanian time may have involved a shift from galactan-rich, algal-type structural polysaccharides to cellulose.—*from* Authors' summary

06169 **Swanson, Earl H., Jr.; Dayley, Jon.** Hunting at Malad Hill in southeastern Idaho: Tebiwa, v. 11, no. 2, p. 59–69, illus., tables, 1968.

A prehistoric hunting station on the north slope of Malad Hill, a divide between the Great Basin and headwaters of the Columbia Basin, was excavated and two periods of human use were identified; each occupation was associated with a fossil humus horizon. The site is enclosed in floodplain deposits of Devil Creek; a sequence of deposits based on profiles drawn during excavation and from observations is correlated with measured sections prepared in the field and compares favorably with others in the Northern Rocky Mts. transect. The earliest deposit, Bed 7, a rounded boulder gravel, corresponds to comparable stream gravels that have been dated at 12,410 yr B.P. and may represent the climax of Pinedale glaciation. All seven beds are described and related to climate. The early occupation would date between 6,200 and 5,200 B.C., and the later one, probably after 1,000 B.C. Artifacts from both levels are described and illustrated.—ESL

Sweet, Walter C. *See* Kohut, Joseph J. 06030

05879 **Swenson, Frank A.** Recharge and movement of water in the artesian basin of the Dakotas, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 199–207, illus., tables, 1968.

According to a new theory of ground-water movement in the region, much of the water developed from the Dakota Sandstone in eastern South Dakota and North Dakota entered the cavernous Englewood of Devonian age and the Pahasapa of Mississippian age as recharge on the flanks of the Black Hills. The water moved eastward through the limestone. When it reaches the area, east of the Missouri River, where pre-Dakota erosion has removed most if not all of the intervening rocks, the water moves upward and enters the Dakota Sandstone.—HRC

Swift, Donald J. P. *See* Stanley, Daniel K. 00202

06123 **Swift, Donald J. P.; Lyall, Anil K.** Origin of the Bay of Fundy, an interpretation from sub-bottom profiles: Marine Geology, v. 6, no. 4, p. 331–343, illus., 1968.

Sub-bottom profiles [using a hydrosonde profiling system] in the Bay of Fundy show that the topographic depression is controlled by the Acadian Structural Basin, through the medium of differential erosion. Take's [unpublished] data suggest that fluvial erosion initiated the Bay of Fundy. However, the profiles show that Quaternary glaciation obliterated older land forms on the floor of the Bay, and reduced it to a glacial pavement thinly veneered with glacial drift. Hence the Bay owes its present form primarily to glaciation. Although pre-Quaternary deposits have been reported by Uchupi (1966) from the Gulf of Maine, and by Take from the Shubenacadie Valley, none have been identified in the Bay of Fundy.—*from* Authors' conclusions

Swinchatt, Jonathan P. *See* Cottrell, John. 00276

Swirczynski, R. P. *See* Gueis, Roy H. 05907

05910 **Swirczynski, Richard P.** Kitty field, Campbell County, Wyoming, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 67–71, illus., 1968.

The Muddy Formation is used to designate the interval of interbedded siltstones, sandstones, and shales beneath the Mowry and above the Skull Creek Shale. The Muddy contains a variety of types of deposits ranging from continental aqueous beds through marine neritic beds. There are three reservoir units in the Kitty field area. The upper, a poor producer, is sand and silt ranging from 6 to 20 feet thick. The middle member, more sand and silt, includes several thin shale beds and varies from two thin tight siltstones or sandstones to as much as 35 feet of gross zone with a net of 22 feet of porous reservoir zone. The lower member, poorly known, is silty sand and has a maximum sand thickness of 16 feet.—HRC

Syers, J. K. *See* Rex, R. W. 00140

Syers, J. K. *See* Dolcater, D. L. 05961

05889 **Sykes, Lynn R.** Seismological evidence for transform faults, sea floor spreading, and continental drift, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966 , Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 120–150, illus., tables, discussion, 1968.

Data from 30 earthquakes on midoceanic ridges and extensions of the ridge system indicate that the earthquake mechanism involved either predominant strike-slip movement on steeply dipping planes or a large component of normal faulting with the inferred axis of tension approximately perpendicular to the ridges. The former characterizes events in major fracture zones intersecting ridge crests and is in general agreement with the predicted sense of displacement of transform faults. The latter mechaniim is apparently restricted to areas of the ridge system in which there are

no fracture zones. Sea-floor spreading at or near the crest of the midoceanic ridge system probably accounts for transform faults and the distribution of earthquakes, which, in turn, are controlled by a large-scale, not yet clearly understood system of forces in the mantle.—MS

Szabo, N. L. *See* Wolfe, W. J. 06067

05993 **Szalay, Frederick S.** Origins of the Apatemyidae (Mammalia, Insectivora): Am. Mus. Novitates, no. 2352, 11 p., illus., table, 1968.

The discovery in south-central Wyoming of upper molars of *Jepsenella praepropera* has allowed speculations concerning the origin of the Apatemyoidea. Available evidence suggests that in respect to the specialized construction of the incisors and the molar morphology, the apatemyids evolved from palaeoryctids during the late Cretaceous. Lepticitid origins for either the Apatemyoidea or Erinaceoidea appear unlikely.—KAF

06319 **Taft, William H.; Arrington, Frank; Haimovitz, Allen; MacDonald, Catheryn; Woolheater, Charles.** Lithification of modern marine carbonate sediments at Yellow Bank, Bahamas [with Spanish abs.]: Bull. Marine Sci., v. 18, no. 4, p. 762-828, illus., tables, 1968.

The mineralogy, chemistry, distribution of grain size, diagenesis, and ages of modern carbonates accumulating on the New Providence Platform have been studied. Lithification by aragonite cement is taking place beneath 16 feet of sea water in sediments never exposed to fresh water as determined by virtual absence of low-magnesium calcite and lack of recrystallization of aragonite and high-magnesium calcite. Depth of water and abundance of plant life appear to localize lithification at sites termed bioherms. Significant vertical variations in facies are in the modern carbonates overlying the recrystallized, chemically dissolved Pleistocene biosparite. Silt- and clay-sized particles of unconsolidated modern carbonates rest unconformably on the biosparite and increase progressively in size toward the surface. Modern lithified material is rarely found deeper than three feet below the water-sediment interface.—*from* Authors' abstract

Takahashi, Taro. *See* Mao, Ho-Kwang. 00061

06039 **Tanner, William F.** Shallow lake deposits, lower part of Morrison Formation (late Jurassic), northern New Mexico: Mtn. Geologist, v. 5, no. 4, p. 187-195, illus., 1968.

Various parameters, calculated from measurements taken on ripple marks in sandstones of the basal Morrison Formation in Rio Arriba County, show that the sands accumulated in a wide, shallow lake, primarily as the result of fair-weather wave activity. The water depth was about 3 m, and the width of the lake was more than 15 km and perhaps as much as 150 km. The change from lacustrine to floodplain or alluvial conditions of deposition appears to have taken place after the lower sandstones of the Morrison were deposited. Extension of the history of lacustrine deposition is pertinent to an understanding of the origin of the Todilto gypsum and its unusual gross geometry.—*from* Author's summary

06032 **Tappan, Helen; Loeblich, Alfred R., Jr.** Lorica composition of modern and fossil Tintinnida (ciliate Protozoa), systematics, geologic distribution, and some new Tertiary taxa: Jour. Paleontology, v. 42, no. 6, p. 1378-1394, illus., 1968.

Two superfamilies are proposed for the order Tintinnida: Codonellidea (new) contains the families Tintinnidiidae, Codonellidae, Codonellopsidae, Coxliellidae, and probably Dictyocystidae, Eppiplocylididae, Petalotrichidae. They have a pronounced ciliary membrane and a relatively solidly constructed lorica, commonly with spiral structures, and with agglutinated particles in the wall. Tintinnidea (emended) contains the remaining families, Cyttarocylididae, Ptychocylididae, Rhabdonellidae, Xystonellidae, Undellidae, and Tintinnidae. They lack a ciliary membrane; the lorica is thin, hyaline, and organic without agglutinated particles, and has vertical or transverse, not spiral, structures. Previously proposed superfamily Calpionellidea is not recognized. Two new genera and species of

Codonellidae are described from upper Eocene of Mississippi.—*from* Authors' abstract

00060 **Tatsumoto, M.; Snavely, P. D., Jr.** Isotopic composition of lead in rocks of the Coast Range, Oregon and Washington: Jour. Geophys. Research, v. 74, no. 4, p. 1087–1100, illus., tables, 1969.

The isotopic compositions of Pb, as well as the Pb, U, and Th concentrations, have been determined in extrusive and intrusive rocks and in sedimentary rocks from Oregon and in two extrusive rocks from Washington. The isotopic composition of Pb was found to vary considerably, so that the model Pb–206/Pb–207 isochron ages vary from +100 to –1100 m.y. The results suggest: (1) the volcanic rocks were generated from more than one source. The source region of the Miocene basalts is thought to be a part of the upper mantle that evolved during Precambrian time. (2) The variation in the isotopic composition of Pb in differentiated suites may have been caused by different magma sources, or by assimilation of different kinds of Pb from the wallrocks of the magma reservoirs and(or) conduits into the magma.—*from* Authors' abstract

Taylor, W. Harlan. *See* Wells, Kenneth R. 00153

06037 **Teichurt, Curt.** Stratigraphic nomenclature in Devonian of central Arizona: Mtn. Geologist, v. 5, no. 4, p. 179–180, 1968.

It is suggested that the Martin Formation, Jerome Member, and the Beckers Butte Member be upgraded in rank to Martin Group, Jerome Formation, and Beckers Butte Sandstone.—Author's abstract

05915 **Tenney, Charles S.** Heavy oil in Minnelusa in northern Black Hills, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 95–99, illus., 1968.

The occurrence of heavy oil in the Minnelusa Formation is common in the northern Black Hills area. Concentration tends to be associated with structural anomalies, although it would appear that Minnelusa stratigraphy probably is as complicated here as it is in the Powder River basin. Goose Egg isopachs tend to bear little relationship to oil occurrence, saturated section thickness, or present day structure. Therefore, migration is suspected, and the present structure bears little relationship with older features. Ten million barrels of low gravity oil are present in the Burnt Hollow field. Production problems are numerous.—HRC

05967 **Tettenhorst, Rodney; Levinson, A. A.; McGuire, Robert C.** X-ray data on a fractionated regularly interstratified clay: Am. Mineralogist, v. 53, nos. 3–4, p. 472–477, illus., table, 1968.

A 1:1 regularly interstratified clay was examined by X-ray diffraction and shown to be a chlorite:expandable clay mixture. Expandability was not related to particle size. Edge effects of small particles cannot be directly correlated with expansion, charge density, or other parameters.—Authors' abstract

00205 **Textoris, Daniel A.** Petrology of Middle Ordovician supratidal carbonates and associated facies, Black River Group of New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 58–59, 1969.

06009 **Thachuk, Norman M.** Geological study of the Middle Devonian Gilwood arkoses in the Nipisi area, Alberta: Jour. Canadian Petroleum Technology, v. 7, no. 4, p. 181–194, illus., 1968.

The Gilwood sandstone member of the Watt Mountain Formation was deposited as interbedded arkoses and shales along the shoreline of a broad, shallow sea bordering the eastern flank of the Peace River Precambrian High. A shallow salt-created depression localized this shoreline, resulting in deposition of a thin clastic dump or fan-like delta containing about 50 feet of sandstone. Nipisi clastics were divided, on the basis of shale units, into four zones, each containing one or more sandstone beds. Shale units were deposited during periods of delta inundation

and/or as clay drape on the upper deltaic plain. Alluvial sandstones were deposited as sheet-like sand bodies by anastomosing streams flowing over a flat delta surface. Small prodeltaic bars along the eastern side of the field appear to be small in areal extent and could be isolated reservoir elements.—*from* Author's abstract

00206 **Thomas, B. R.; VanSchmus, W. R.; Bickford, M. E.; Thomas, J. J.** Composition and cell parameters of authigenic feldspar from the Manlius and Coeymans Formations [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 59, 1969.

Thomas, C. E., Jr. *See* Wilson, W. E. 05944

00207 **Thomas, Hugo F.** Sediment size parameters and mineral composition as a supplement to field identification of glacial deposits [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 59–60, 1969.

Thomas, J. J. *See* Thomas, B. R. 00206

00177 **Thomas, John Jenks.** The detection of low angle thrust surfaces by mesostructural analysis as applied in western Vermont [abs.]: Dissert. Abs., v. 29, no. 6, p. 2092B, 1968; Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 60, 1969.

00178 **Thompson, Allan M.** Upper Ordovician fluvial deposition in the central Appalachians [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 60–61, 1969.

00072 **Thomsen, Leon; Anderson, Orson L.** On the high-temperature equation of state of solids: Jour. Geophys. Research, v. 74, no. 4, p. 981–991, illus., tables, 1969.

Four equations of state for solids are examined for mutual consistency in the high-temperature regime. It is found that neither the Birch–Murnaghan nor the Murnaghan equation can be shown to be consistent with either the Mie–Gruneisen or the Hildebrand equation. An expression for the Gruneisen parameter $\gamma(p)$ is derived in terms of other, more easily measured, thermodynamic properties. The fourth-order anharmonic approximation of lattice dynamics is shown to be sufficient in the lower mantle, insufficient in the upper mantle, and marginal for intense shock waves.—Authors' abstract

05878 **Thorson, Thomas A.** Wyoming bentonite, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 195–197, 1968.

Wyoming bentonite, a product of alteration of volcanic ash, is Cretaceous and was deposited in shallow seas; it contains about 3 to 5 percent grit, part of which is unaltered volcanic debris. A large number of bentonite beds are known; the oldest producing unit is in the Muddy Sandstone and the most prolific producer is the Mowry Formation, although large deposits also are known in the Frontier Formation. The Steele Shale is the youngest formation to produce bentonite. There are eight separate producing zones which are at least two feet thick, although many other thinner ones exist. A discussion of the chemistry and of the swelling and bonding properties of Wyoming bentonite is included. Seventy-five million tons are estimated to be in reserve and the future outlook is encouraging.—HRC

Thurber, David L. *See* Newman, Walter S. 00236

Tidwell, William D. *See* Rushforth, Samuel R. 06140

00179 **Ting, Francis T. C.** Reflectance of disseminated vitrinite as a diagenetic indicator in sedimentary rocks [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 61, 1969.

00085 **Toffaleti, Fred B.** Definitive computations of sand discharge in rivers: Am. Soc. Civil Engineers Proc., v. 95, paper 6350, Jour. Hydraulics Div., no. HY 1, p. 225–248, illus., 1969.

A procedure for an analytic determination of sand discharge in streams is presented especially adaptable to computer programming, requiring only a modicum of input or given data from which the sand discharge fractions are both separately and in combination completely described quantitatively and in distribution from bed to water surface. It has been tested by application and comparison with observed data in all types of rivers, small to large, under a full range of flow conditions, and to model flume experiments conducted under widely varying flow conditions with bed sands varying widely in size and size distribution. It is considered that the results by this procedure are sufficiently accurate to warrant its use in many types of studies involving quantitative sand transport, design of channels, channel regulation works, and the assessment of probable effects of channel modifications.—Author's abstract

05864 **Tourtelot, Harry A.; Cobban, W. A.** Stratigraphic significance and petrology of phosphate nodules at base of Niobrara Formation, east flank of Black Hills, South Dakota: U.S. Geol. Survey Prof. Paper 594-L, p. L1-L20, illus., 1968.

Inocerams and ammonites preserved as internal molds on phosphate nodules are assigned a late Turonian age that has not heretofore been recorded in the Black Hills region. The phosphate nodules are interpreted to have formed by the phosphatic replacement of marlstone in the living chambers of ammonites and in the space between inoceramid shells. Decaying flesh of the mollusks produced a microenvironment favorable for the replacement process. The marlstone surrounding the nodules was then eroded leaving the nodules concentrated along a plane that became the base of the Niobrara Formation.—HAT

Tracey, Joshua I., Jr. *See* Gross, M. Grant. 00092

Trudell, Laurence G. *See* Smith, John Ward. 06152

06145 **Tucker, L. R.** Geophysical activity in 1967 applied to petroleum exploration: Geophysics, v. 33, no. 6, p. 85-902, illus., tables, 1968.

Data compiled from questionnaires sent out by the SEG Geophysical Activity Committee on geophysical activity in petroleum exploration shows total geophysical activity in 1967 was up about 0.5 percent with a 3.0 percent drop in the Western Hemisphere and a 5.0 percent rise in the Eastern Hemisphere. Canada showed a large increase, Australia a large decrease.—KAF

06332 **Turcotte, D. L.; Oxburgh, E. R.** A fluid theory for the deep structure of dip-slip fault zones: Physics Earth and Planetary Interiors, v. 1, no. 6, p. 381-386, illus., 1968.

A one-dimensional fluid model is presented for the deep structure of dip-slip fault zones in island arc areas where oceanic crust appears to be moving down under adjacent continents. A strongly temperature dependent viscosity confines velocity gradients to a narrow fault zone within which viscous dissipation locally heats the fluid and reduces viscosity. Given the slip velocity across the fault zone, the temperature and rates of heat production predicted are in good agreement with observations; the heat production due to viscous heating explains volcanic activity and high surface heat flux associated with island arc areas. Predicted dimensions of the fault zone and heat flux away from the zone are in reasonable agreement with observation.—*from* Authors' abstract

06084 **Turner, J. D.; Scott, J. C.** Geologic map of Covington County, Alabama: Alabama Geol. Survey Map 66, scale about 1 in. to 2 mi., text, 1968.

Geologic units ranging in age from Eocene to Holocene and sedimentary in origin crop out in Covington County. The Tertiary System contains the Eocene Tuscahoma Sand, Tallahatta and Hatchetigbee Formations undifferentiated, Lisbon Formation, and Jackson Group undifferentiated; Oligocene and Miocene series undifferentiated, and residuum; and Quaternary alluvial deposits. Ground water is available for all uses from the Cretaceous Nanafalia Formation, and from Tertiary sands and limestones. Economic mineral resources include brown iron ore from the Lisbon,

sand and gravel from Eocene and Quaternary deposits, and clay in Eocene formations.—MCM

Uehara, G. *See* Sharma, M. L. 05933

Uehara, G. *See* Kunze, R. J. 05966

06181 **Uken, Ernst A.; Santos, Gabriel; Wainerdi, Richard E.** Neutron-activation analysis for the study of metallogenic provinces: Talanta, v. 15, no. 11, p. 1097-1109, illus., table, 1968.

The application of instrumental neutron-activation analysis to the study of metallogenic provinces is outlined. Iron, scandium, and lanthanum are measured in uncrushed, whole-rock specimens, and the results indicate trace-element compositional trends over the 50-mile traverse studied. These trends extend through a number of different formations and rock types, and reflect structural features mapped by others using conventional techniques.—Authors' abstract

00096 **UnderSea Technology Staff.** Marine minerals—Exploration and speculative leasing continue world-side: UnderSea Technology, v. 10, no. 1, p. 62-63, 74-75, illus., 1969.

Research by the U.S. Government and private companies for gold, heavy minerals, and phosphate on both the east and west coasts, and activities in other parts of the world are reviewed. There is still no adequate tool for the quantitative sampling of high-value mineral deposits offshore. Suction dredges are being used to mine placer deposits.—ESI.

06043 **Upchurch, C. Neil.** The geology of the southwest quarter of the Troy quadrangle, North Carolina [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4, p. 437, 1968.

00097 **U.S. Geological Survey.** Aeromagnetic map of the Winsted quadrangle and parts of the Torrington and Tolland Center quadrangles, Litchfield and Hartford Counties, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-643, scale 1:24,000, 1969.

06128 **Utah Geol. and Mineralog. Survey.** In memoriam, B. F. Stringham: Utah Geol. and Mineralog. Survey Quart. Rev., v. 2, no. 3, p. 6, 1968.

06028 **Utgaard, John.** A revision of North American genera of ceramoporoid bryozoans (Ectoprocta)—Pt. 2, *Crepipora, Ceramoporella, Acanthoceramoporella,* and *Ceramophylla*: Jour. Paleontology, v. 42, no. 6, p. 1444-1455, illus., 1968.

The family Ceramoporidae and the Ordovician genera *Crepipora* Ulrich, *Ceramoporella* Ulrich, and *Ceramophylla* Ulrich are redefined. The new Ordovician genus *Acanthoceramoporella* is included in the family. *Cheiloporella* Ulrich is placed in synonymy with *Ceramoporella*. Several Ordovician species formerly included in *Coeloclema* Ulrich are reassigned to *Ceramophylla*. The microstructure of the lunarial deposit in genera of Ceramoporidae closely resembles that of some Mesozoic and Cenozoic Lichenoporidae. The order Cystoporata probably should be expanded to include the lichenoporoid cyclostomes.—*from* Author's abstract

Vacquier, V. *See* Sclater, J. G. 00073

06080 **VanLandingham, S. L.** Investigation of a diatom population from mine tailings in Nye County, Nevada, U.S.A.: Jour. Phycology, v. 4, no. 4, p. 306-310, illus., table, 1968.

A diatom assemblage of 31 species and varieties of 15 genera was found in tailings from an abandoned mine east of Gabbs, Nye County, Nev. Its age and origin are speculative; Recent age and dry-lake, or possibly soil, origin are most likely. Alkaline and oligohalobous conditions were prevalent as indicated by pH and halobion spectra, the current spectrum indicating indifference. The assemblage is somewhat similar to those of three nearby Recent dry-lake populations, having about 33 percent of the taxa in common. Although a few of the mine-tailings

diatoms apparently are identical with fossil diatoms from deposits in the vicinity and elsewhere, the assemblage is strikingly different from the fossil assemblages in total composition. If the mine-tailings diatoms are fossil, possibly reworked, they are probably no older than Quaternary.—VMJ

VanSchmus, W. R. *See* Thomas, B. R. 00206

00180 **VanTyne, Arthur M.** Subsurface stratigraphy of the Clinton–Medina Groups in New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 62, 1969.

Vaughn, W. W. *See* McCarthy, J. H., Jr. 00166

Vidale, Rosemary J. *See* Burger, H. Robert. 05922

06351 **Vifian, A.; Iwasaki, I.** Mineralogical and beneficiation studies of the copper–nickel bearing Duluth Gabbro: Soc. Mining Engineers Trans., v. 241, no. 4, p. 421–431, illus., tables, 1968.

Samples of copper–nickel ore from the Duluth Gabbro of the Kawashiwi River near Ely, Minn., were studied to relate their mineralogy with amenability to concentration by flotation. The most common rocks—gabbros and troctolites—had textures varying from coarse pegmatitic to very fine; copper contents ranged from 0.2 to 0.7 percent, nickel from 0.07 to 0.15 percent. Ore minerals were chalcopyrite, cubanite, pyrrhotite and pentlandite; most were in interstices between laths of plagioclase, some in gangue grains. Xanthite flotation, after a 65 to 100-mesh grind, recovered about 95 percent of the copper and 85 percent of the nickel in a bulk sulfide concentrate. After a finer grind than 270 mesh, concentrates analyzed 25–39 percent copper and an average 1.5 percent nickel.—*from* Authors' abstract

Vigier, Gaston. *See* Londe, Pierre. 00156

Viirland, Jaak. *See* Jeffs, Donald N. 00255

05899 **Vine, F. J.** Magnetic anomalies associated with mid-ocean ridges, *in* The history of the Earth's crust, a symposium (Robert A. Phinney, editor)—Goddard Inst. Space Studies, 1966, Conf. Contr.: Princeton, N. J., Princeton Univ. Press, p. 73–89, illus., table, discussion, 1968.

Evidence is now abundant that new crust formed at the crest of midoceanic ridges has acquired a remanent magnetization parallel to the ambient direction of the Earth's magnetic field at the time of formation. Strips of essentially normally and reversely magnetized crust represent intermittent field reversals and exhibit a symmetrical distribution relative to axes of the ridges. Magnetic anomaly gradients reflecting the boundaries between the two types of magnetized crust correlate with the magnetic time scale based on absolute age determinations of lavas and serve as a basis for extrapolating rates of ocean-floor spreading. The central anomalies reproduce the reversal time scale. The evidence supports the hypothesis that the present ocean basins have been evolving by a spreading mechanism during the past 200 m.y.—MS

Vogel, Thomas A. *See* Smith, Bennett L. 00100

Voight, Barry. *See* Douglass, P. M. 00266

Vormeringer, Raymond. *See* Londe, Pierre. 00156

06323 **Wacker, Peter O.** The Musconetcong Valley of New Jersey—A historical geography: New Brunswick, N.J., Rutgers Univ. Press, 207 p., illus., 1968.

The drainage system of the Musconetcong River, a 44 mi long tributary of the Delaware River, occupies a long, narrow rift valley 157.6 sq mi in area typical of the Highlands physiographic province of northern New Jersey. The valley has the northeast–southwest trend characteristic of the Highlands and is underlain by a downfolded belt of early Paleozoic limestones and shales bordered by Precambrian

gneisses of the uplands. Many erosional and depositional features of Pleistocene glaciation are evident.This book is a study of evolution of a cultural landscape—the alteration of the natural landscape by man, beginning with first Paleo-Indian occupance about 10,000 years ago and continuing through initial European pioneer occupance to the end of the 18th century, by which time the major cultural components of the present landscape existed.—VMJ

06156 **Waddell, Evans.** Application of systems to the study of landforms [abs.]: Virginia Jour. Sci., v. 19, no. 3, p. 194, 1968.

00169 **Wahrhaftig, Clyde; Wolfe, Jack A.; Leopold, Estella B.; Lanphere, Marvin A.** The coal-bearing group in the Nenana coal field, Alaska: U.S. Geol. Survey Bull. 1274-D, p. D1-D30, illus., table, 1969.

The coal-bearing group of rocks of the Nenana coal field in the central part of the Alaska Range is formally subdivided into five new formations, in ascending order: the Healy Creek, Sanctuary, Suntrana, Lignite Creek, and Grubstake Formations. Fossil leaves and pollen indicate that the coal-bearing group, which is wholly continental, ranges in age from the late Oligocene through the late Miocene. Volcanic glass from the Grubstake Formation has an apparent age of 8.1 million years, based on potassium-argon analyses.—Authors' abstract

Wainerdi, Richard E. *See* Uken, Ernst A. 06181

Waines, Russell H. *See* Johnsen, John H. 00256

00181 **Walker, Kenneth R.** Nearshore carbonate environmental array of the Middle Ordovician Black River Group of New York State and its stratigraphic consequences [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 62-63, 1969.

06058 **Walker, L. K.; Raymond, G. P.** The prediction of consolidation rates in a cemented clay [with French abs.]: Canadian Geotech. Jour., v. 5, no. 4, p. 192-216, illus., tables, 1968.

In this study of consolidation rates in Leda clay, Ottawa, Ontario, two modified versions of Terzaghi's consolidation theory have been considered in interpretation of experimental data. These theories, Raymond (1966a) and Barden (1965), are outlined briefly in section 1. In section 2, a detailed study of primary consolidation rates is made, with comparison and discussion of theoretical and experimental curves. In section 3, experimental data on secondary consolidation is presented. In both sections 2 and 3, discussion is restricted to the characteristics obtained from samples at one depth, 70 feet. Data are presented in section 4 to illustrate the variation in consolidation behavior of samples from different depths in the soil profile.—ESL

00154 **Walker, Leonard K.** Secondary compression in the shear of clays: Am. Soc. Civil Engineers Proc., v. 95, paper 6348, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 167-188, illus., tables, 1969.

The amount of secondary deformation measured when shear-testing a laboratory sample of kaolin depends largely on its effective stress state, which may vary from a hydrostatic state of stress to stresses causing incipient failure in the specimen. Such deformation does not, however, appear to influence the basic stress-strain curve for the material, as this is essentially independent of load duration. Thus, in a limited sense, the stress-strain relationship may be considered as time independent. Secondary deformation data from drained shear tests are decomposed into volumetric and shear components. In this way, creep in shear is interpreted as a stress-dilatancy phenomenon, and as such may be contrasted with similar relationships which describe the process of primary deformation in shear tests. Author's abstract

00160 **Walker, Leonard K.** General stress-strain-time function for soils—Discussion [of paper 5728 by A. Singh and J. K. Mitchell, 1968]: Am. Soc. Civil Engineers

Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 409–415, 1969.

The variable nature of the parameters in the equation given by Singh and Mitchell [ibid., v. 94, no. SM 1, p. 21–46] is emphasized. Walker attempts to assess this equation in terms of some current concepts of the mechanism of the shearing deformation of clays: use of the term "creep", definition of parameters, and primary deformation.—ESL

06029 **Wall, David; Dale, Barrie.** Quaternary calcareous dinoflagellates (Calciodinellidae) and their natural affinities: Jour. Paleontology, v. 42, no. 6, p. 1395–1408, illus., 1968.

Calciodinellum operosum Deflandre 1947, type genus of the family Calciodinellidae, and eight new morphotypes of calcareous dinoflagellates have been discovered in Quaternary marine sediments from the North Atlantic and Western Indian oceans, Mediterranean and Caribbean seas. Six of these have been isolated alive and studied in incubation experiments; so far two types have been germinated to produce motile thecate dinoflagellates identified as *Peridinium trochoideum* and *Scrippsiella sweenyae*; four others have produced athecate hypnoid protoplasts of a type commonly seen in cultures of those species among others. We conclude that Quaternary calciodinellids are peridinioid resting cysts having apical archeopyles and are produced by a small monophyletic group of dinoflagellates with the unique capability of primary calcification. Mesozoic and Tertiary calciodinellids probably are homologous with these Quaternary types.—*from* Authors' abstract

Walmsley, V. G. *See* Harper, Charles W., Jr. 00106

00116 **Warme, John E.** Live and dead molluscs in a coastal lagoon: Jour. Paleontology, v. 43, no. 1, p. 141–150, illus., tables, 1969.

Abundance and distribution of living animals and empty shells of 73 molluscan species collected in 55 samples from Mugu Lagoon in southern California were studied to determine post-mortem movement of shells. Taxa of animals collected alive are adequately reflected by empty shells accumulating in the lagoon, whether compared on the basis of individual taxa, whole communities, or relative abundances within communities. Post-mortem transporation in this environment is shown to be insignificant for most paleoecological purposes.—JWH

00081 **Warner, Don L.** Preliminary field studies using earth resistivity measurements for delineating zones of contaminated ground water: Ground Water, v. 7, no. 1, p. 9–16, illus., 1969.

The measure of earth resistivity is a possible means of detecting and outlining zones of ground-water contamination where a resistivity contrast exists between contaminated and uncontaminated water. As a preliminary evaluation of the use of electrical resistivity for defining zones of contaminated water, five sites on Long Island, and three sites in western Texas were examined. The surveys at three of the Long Island sites and at one of the Texas sites were at least partially successful in their objectives. The lack of success at the other sites is attributed to the particular physical conditions that existed. Further effort toward developing electrical resistivity as a method for evaluating variations in ground-water quality is encouraged.—Author's abstract

00098 **Warren, David H.** A seismic-refraction survey of crustal structure in central Arizona: Geol. Soc. America Bull., v. 80, no. 2, p. 257–282, illus., tables, 1969.

Two recording lines 400 km long intersect in the form of a cross at the Mogollon Rim near Payson, central Arizona. The M-discontinuity is about 21 km below sea level 200 kr to the southwest, dips 5° to the northeast to a depth of 35 km under Mogollon Rim, and is nearly flat with a depth of about 40 km under the Colorado Plateau to the northeast. The upper mantle velocity is 7.85 kmps. Lateral density change in the upper mantle is required to make the crustal-refraction model fit observed gravity data.—AG

Warshauer, S. M. *See* Finks, R. M. 00272

06141 **Washburn, Alan T.** Early Pennsylvanian crinoids from the south-central Wasatch Mountains of central Utah: Brigham Young Univ. Geology Studies, v. 15, pt. 1, p. 115–132, illus., tables, 1968.

The lower Pennsylvanian part of the Oquirrh Formation, in Provo Canyon, Utah County, contains a diverse crinoid fauna in a rhythmic sequence of alternating limestone and shaly limestone. Articulated specimens are found on the upper surface of mounds of limestone buried by the more shaly strata. Three new species of *Hypselocrinus*, two of *Cymbiocrinus*, two of *Delocrinus*, and one species each of *Aesiocrinus*, *Globocrinus*, *Synarmocrinus*, and *Phanocrinus* are described and figured. Twenty-two specimens have been found representing eleven species.—*from* Authors' abstract

00051 **Waterhouse, J. B.** Permian Strophalosiidae (Brachiopoda) from the Canadian Arctic Archipelago: Jour. Paleontology, v. 43, no. 1, p. 28–40, illus., tables, 1969.

Four strophalosiid species are described from the Upper Permian deposits of Melville, Ellesmere, and Cameron Islands of the Canadian Arctic Archipelago: *Echinalosia* sp., *Wyndhamia sphenarctica* n.sp., *W. unispinosa* n.sp., and *Craspedalosia pulchella* (Dunbar). Changes are proposed in the classification of the Strophalosiidae offered by Muir-Wood and Cooper (1960) and Muir-Wood (1965). The subfamily Strophalosiinae is emended to include genera allied to *Strophalosia*, with or without spines on the brachial valve. It is recommended that the subfamily Heteralosiinae be suppressed.—Author's abstract

06088 **Watkins, Frank A., Jr.; Nyman, Dale J.** Ground-water appraisal of the Little Wabash Basin above the gage below Clay City and the Louisville Reservoir site, Illinois, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V. 2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 251–263, illus., table, 1968.

Moderate to large supplies of ground water are available from sand and gravel in some areas and are possible in others if the deposits are thick and areally extensive. Chemical quality of the ground water from the upper 250 feet of bedrock is usually good, with total dissolved solids ranging from about 500 to more than 1,300 ppm; at depths greater than 250 feet below the top of the rock, the water is usually not potable. Water from sand and gravel aquifers is generally good, with total dissolved solids ranging from about 300 to more than 850 ppm, and of more uniform quality than that from bedrock sources.—MCM

06089 **Watkins, Frank A., Jr.** Ground-water appraisal of the Skillet Fork Basin above Wayne City and Helm Reservoir site, Illinois, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V. 2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 265–275, illus., table, 1968.

Moderate to large supplies of ground water are not available in the Skillet Fork Basin above Wayne City. Shale, sandstone, limestone, and coal of Pennsylvanian age are the sources of only small supplies due to small permeability and lack of secondary openings in these rocks. Till, sand, and gravel of Pleistocene age are sources of small supplies, with the exception of a small area west of Iuka where moderate supplies may be possible from sand and gravel. Chemical quality from the upper 250 feet of bedrock is usually good with total dissolved solids generally less than 500 ppm; quality becomes poorer at depths greater than 250 feet below the top of the rock.—MCM

06090 **Watkins, Frank A., Jr.** Ground-water appraisal of the Big Walnut Creek basin above Little Walnut Creek and Big Walnut Creek Reservoir site, Indiana, *in* Interim Rept. 3, Wabash River Basin comprehensive study, Indiana, Illinois, and Ohio, V. 2: U.S. Cong., 90th, 2d sess., Senate Doc. 96, p. 277–288, illus., table, 1968.

Sources of small supplies of ground water are: Devonian and Mississippian shale; Mississippian shale, limestone, and sandy shale; Pleistocene sand and gravel in the central part of the basin; and Pleistocene till that contains some sand and gravel.

Moderate to large supplies are available from Pleistocene outwash sand and gravel and from sand and gravel interbedded with till in the buried bedrock valley if it is thick and areally extensive. Water from the upper 250 feet of bedrock and from sand and gravel is generally of good quality, with total dissolved solids usually less than 500 ppm; it is usually not potable at depths greater than 250 feet below the top of the rock.—MCM

Watkins, Frank A., Jr. *See* Nyman, Dale J. 06091

Watkins, Frank A., Jr. *See* Nyman, Dale J. 06092

06137 **Watson, Robert A.** Structural development of the Toquerville–Pintura segment of the Hurricane Cliffs, Utah: Brigham Young Univ. Geology Studies, v. 15, pt. 1, p. 67–76, illus., 1968.

The section of the Hurricane Cliffs north of Toquerville is an asymmetrical anticline plunging north and truncated on the south by the eastward bend of the Hurricane fault trace. Minor structures include thrust faults and related compressional folds, antithetic faults, normal faults, and drag folding into the west-dipping Hurricane fault zone. The east flank of the fold dips about 40° E.; the west flank 25° to 30°, with abrupt increase to 65° where flexed into the Hurricane fault zone. Overall structure appears to be the result of several periods of deformation beginning in Cretaceous: first, a long north-trending anticline, subsequently modified by successive periods of normal faulting along its axis north of Toquerville. The east flank represents the remnant Laramide fold, the steeper west limb a later drag flexure.—*from* Author's abstract

Weaver, J. Scott. *See* Mao, Ho-Kwang. 00061

00182 **Weaver, Kenneth N.; Cleaves, Emery T.** Geology and the "new city" concept—Columbia, Maryland [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 63, 1969.

05968 **Weber, J. B.** The effect of adsorbent charge on the competitive adsorption of divalent organic cations by layer-silicate minerals: Am. Mineralogist, v. 53, nos. 3–4, p. 478–490, illus., tables, 1968.

Competitive adsorption isotherms for diquat (1,1′-ethylene-2,2′-dipyridilium dibromide) *vs* paraquat (1,1′-dimethyl-4,4′-dipyridilium dichloride) on three-layer clay minerals varying in surface charge density were determined. Both chemicals dissociate in water to form divalent organic cations. Paraquat was preferentially adsorbed on all montmorillonites and on the external surface of vermiculite whereas diquat was preferentially adsorbed on the internal surface of vermiculite and on the external surface of nonexpanded mica. The data indicate that structural charge on layer silicates is expressed as discrete adsorption sites rather than a smear of surface charge.—*from* Author's abstract

00161 **Weber, William G., Jr.** Performance of embankments constructed over peat: Am. Soc. Civil Engineers Proc., v. 95, paper 6333, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 53–76, illus., tables, 1969.

The performance of three sections of roadway, constructed upon a peat deposit [Sacramento and San Joaquin Rivers delta area, Calif.], are compared to the predictions from engineering tests prior to construction. The use of sand drains appears to increase the stability of the fill but has little or no effect upon the rate of settlement. The loading settlement was predicted with reasonable accuracy from the consolidation tests. The long-term settlement rates could not be predicted from the engineering properties of the peat, but was reduced by the use of overloads.—*from* Editor's abstract

06176 **Weinaug, C. F.** Mathematical modeling of reservoir behavior, *in* Computer applications in the earth sciences—Colloquium on simulation: Kansas Geol. Survey Computer Contr. 22, p. 52–58, illus., 1968.

A well-known simulation technique for gas reservoirs is presented with the hope that these methods might be applied to different geologic processes. Since the advent of large-scale digital computers, solutions to some types of differential equations describing plastic-elastic deformation and fluid flow are obtained by difference equation techniques. As an illustration, the method is applied to gas fields, and the differential equation developed is converted into a set of difference equations, which can be solved by a digital computer. Results are shown.—ESL

Weist, W. G., Jr. *See* Kantrowitz, I. H. 00216

00153 **Wells, Kenneth R.; Taylor, W. Harlan.** Memorial, Chester Sappington (1905–1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 188–190, portrait, 1969.

00119 **West, Robert M.** *Paramys wyomingensis*, a small rodent from the middle Eocene of Wyoming: Jour. Paleontology, v. 43, no. 1, p. 175–178, illus., table, 1969.

Microparamys wyomingensis Wood is reassigned to the genus *Paramys* on the basis of material collected [from the Bridger Formation and equivalent beds, northern Green River Basin] Sublette County, Wyoming, during 1966 and 1967. Examination of *Paramys wyomingensis* suggests a relationship to the Wasatchian paramyine *Paramys copei copei*. It is possible that *Paramys wyomingensis* of the Bridger is ancestral to the early Oligocene *Prosciurus*.—Author's abstract

05870 **Westoll, T. S.** Sedimentary rhythms in coal-bearing strata, *in* Coal and coal-bearing strata (D. Murchison and T. S. Westoll, editors): New York, American Elsevier Publishing Co., p. 71–103, illus., table, 1968.

Differences in terminology are discussed. Sequences of cyclothems are known from lower Devonian and earlier, and from most continents; in a restricted sense they are known from early Carboniferous to the present, and are usually coal-bearing in some part. The main varieties and their sedimentary environments are described. Important factors that must be taken into account in all rhythmic sequences include: accumulation of a considerable thickness of sediments deposited close to sea level; repeated formation of deltaic complexes;repeated inundation of the delta-complexes by shallow marine waters; and varying capacity of the sediments to suffer compaction and diagenetic change. It is proposed that the term fascicule be used, defined as reaching from the top or base of a recognized bed or seam to the top or base of another above it.—ESL

05871 **Westoll, T. S.** Vertebrate faunas of coal-bearing strata, *in* Coal and coal-bearing strata (D. Murchison and T. S. Westoll, editors): New York, American Elsevier Publishing Co., p. 179–193, illus., 1968.

Vertebrate faunas of deltaic-swamp or lacustrine-swamp environments are frequently well known because of economic exploitation of coal-bearing strata. Representatives of more upland faunas are occasionally found in channel deposits, and may be very different. The best-known Carboniferous Coal-Measures occurrences of Europe and North America are discussed. Adaptation of certain elements of the faunas to narrow ranges of salinity is crucial to understanding of migration. The tetrapods that adapted to life in coal swamps were largely amphibians; rare finds adapted to terrestrial life include several kinds of primitive reptiles. Fish faunas extend through the whole range of coal-bearing rocks, from the Early Devonian onward; special features are noted. From late Carboniferous to Quaternary peat-bearing strata, tetrapods give the most interesting information.—*from* Author's abstract

Westoll, T. Stanley. *See* Murchison, Duncan. 05888

White, Donald E. *See* Muffler, L. J. Patrick. 00113

Whiteside, Melbourne C. *See* Harmsworth, Rodney V. 06125

00170 **Whitman, Robert V.; Bailey, William A.** Use of computers for slope stability analysis—Closure [to discussion of paper 5327, 1967]: Am. Soc. Civil Engineers

Proc., v. 95, paper 6324, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 335, 1969.

The writers wish to thank Starr [ibid., v. 94, paper 5922, no. SM 3, p. 784–789, 1968] for his excellent illustration of the use of the Morgenstern–Price method in practical work. A very thorough and complete stability analysis was certainly justified by the complexity and importance of the Mangla Project. For most projects, however, it will be satisfactory to do the major portion of the stability analysis by simple methods, such as the simplified Bishop or Wedge method, possibly using the Morgenstern–Price method to check the final results.—Authors' discussion

Whittig, L. D. *See* Wildman, W. E. 05960

05960 **Wildman, W. E.; Jackson, M. L.; Whittig, L. D.** Iron-rich montmorillonite formation in soils derived from serpentinite: Soil Sci. Soc. America Proc., v. 32, no. 6, p. 787–794, illus., tables, 1968.

Montmorillonite is the predominant clay mineral in B horizons of four widely separated California soils derived from serpentinite. The $<0.2\mu$ fractions from the Henneke, Dubakella, and Fancher series contain 61, 68, and 71 percent and one from the New Idria area, 33 percent montmorillonite, according to CEC determination. In their chemical analysis, much of the MgO can be attributed to $<0.1\mu$ serpentine minerals, identified by electron microscopy. Montmorillonite, calculated for the four soil clays, has a high content of Fe in octahedral position; Mg is the predominant exchange cation (about 68 percent) in the <2 mm soil. In contrast with soil clays, parent serpentinite has lower SiO_2 and Fe_2O_3 (after magnetite removal), higher MgO, and lower Al_2O_3. Leaching of serpentinite removed much of the Mg; Si, Fe, and Al were enriched concurrently in pedogenic formation of montmorillonite.—GDC

06015 **Willman, H. B.; Simon, Jack A.; Lynch, Betty M.; Langenheim, Virginia A.** Bibliography and index of Illinois geology through 1965: Illinois Geol. Survey Bull. 92, 373 p., 1968.

06329 **Wilson, J. Tuzo.** A revolution in earth science: Canadian Mining and Metall. Bull., v. 61, no. 670, p. 185–192, illus., 1968; reprinted *in* Debate about the Earth: Geotimes, v. 13, no. 10, p. 10–16, illus., 1968; reply to V. V. Belousov, ibid., p. 20–22, illus., 1968.

Measurements of three different features of the Earth all change in exactly the same ratios. The first is the direction of magnetic polarity in lava flows; the second, that of widths of successive strips of magnetic anomalies over ocean basins; and the third magnetic reversals in deep sea cores. These suggest that the ocean floor is being generated along midocean ridges and carried away at uniform velocities. The mechanism which causes the surface to move is considered to be upwelling and outward flow from midocean ridges, matched elsewhere by downward flow and compression. The impact of this theory on earth science, on teaching in universities, and on industry is discussed. It is suggested that the traditional subjects of geology can be better taught and more easily understood after the principles of Earth behavior are mastered.—ESL

05944 **Wilson, W. E.; Ryder, R. B.; Thomas, C. E., Jr.** Hydrogeology of southwestern Connecticut, Trip B-3 *in* Guidebook for field trips in Connecticut—New England Intercollegiate Geol. Conf., 60th Ann. Mtg., New Haven, Conn., 1968: Connecticut Geol. and Nat. History Survey Guidebook 2, 33 p., paged separately, illus., 1968.

Aquifers in the area are stratified glacial drift, till, and bedrock; each has distinctive distribution, geometry, and water-bearing properties. The stratified drift, principal aquifer for large-scale development, is a long, narrow aquifer, generally following valleys. The quality of the water is influenced greatly by the surface infiltration of pollutants. A road log for a one-day field trip of 158 miles, containing seven stops is included.—HRC

Windom, Herbert. *See* Griffin, John J. 05986

00183 **Withington, Charles F.** Engineering geology in urban affairs [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 63–64, 1969.

00054 **Withrow, Philip C.** Hunton geology of the Star–Lacey Field, Blaine and Kingfisher Counties, Oklahoma: Shale Shaker, v. 19, no. 5, p. 78–88, illus., 1969.

On the northern shelf of the Anadarko basin, the Star field producing gas from the top of the Devonian Hunton Group, and the S. W. Lacey field oil and gas from the Silurian lower Hunton and Mississippian limestone, have different trapping mechanisms but nearly overlap in one area. Together, characteristic of Hunton traps throughout the basin, they have the following significant relationships: an eroded top surface of the Hunton with relief that can affect structure maps drawn on this horizon; within the Group, thickness of zones not related to post-Hunton erosion; evidence of several unconformities; porous dolomite at all stratigraphic levels, with that in the Chimneyhill formation possibly over structural or stratigraphic anomalies. Small isopach and structure contour maps, and correlative cross sections illustrate the brief description of stratigraphy and structure in this area of potential additional prolific Hunton fields.—GDC

05901 **Wold, John S.; Woodward, Thomas C.** Project Thunderbird: World Oil, v. 166, no. 6, p. 111–112, 117, 120, illus., table, 1968; *reprinted in part in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 147–153, illus., table, 1968.

The project, an *in situ* coal-energy experimental program, is in the Powder River basin of Wyoming in an area underlain by more than 20 billion tons of coal. The coals, five in number, are in the Tertiary Fort Union Formation. The energy may have more than twice the Btu value of all the proven oil reserves in the United States. The total coal interval, at a depth of 1,000–2,000 feet, may be the thickest in the western hemisphere. A 50-kiloton nuclear test would create an immense underground coke oven. The gas could be drawn off and upgraded at the surface, and the gas and liquids could then be shipped by pipeline.—HRC

Wolfe, Jack A. *See* Wahrhaftig, Clyde. 00169

06067 **Wolfe, W. J.; Szabo, N. L.** The Cu, Pb, Zn, Mn and Mo content of stream and spring sediments, parts of Charlotte, St. John and Kings Counties, New Brunswick: New Brunswick Dept. Nat. Resources Mineral Resources Br. Rept. Inv. 6, 6 sheets, maps scale 1:100,000, texts, 1968.

The six sheets contain a geological map and maps showing copper, lead, zinc, manganese, and molybdenum content of stream and spring sediments of the area which covers a NE-trending belt of rocks ranging in age from Precambrian(?) to Triassic. A major NE strike fault traverses the area over a distance of 50 mi and divides it into two parallel zones of contrasting age and tectonic development. Copper content of stream sediments ranges from less than 1 to 440 ppm; dispersion trains of copper are commonly short, and a number of isolated high values occur. Lead content ranges from 5–460 ppm, zinc from 2–570 ppm, manganese from 5–105,000 ppm, and molybdenum from less than 1 to 83 ppm. Contents should be interpreted with respect to the geological environment shown on Map 1 and compared with contents of individual elements on each of the other maps.—MCM

00066 **Wood, Gordon H., Jr.; Arndt, Harold H.; Carter, M. Devereux.** Systematic jointing in the western part of the Anthracite region of eastern Pennsylvania: U.S. Geol. Survey Bull. 1271-D, p. D1–D17, illus., 1969.

A conjugate joint system of strike and dip sets occurs in Lower Silurian to Upper Pennsylvanian rocks in the western part of the Anthracite region of eastern Pennsylvania. The joint system formed before and during the early stages of folding of the Appalachian orogeny. The bearings of the joint sets in the report area are similar to the bearings of joint sets noted by other geologists in the Appalachian Plateaus and Valley and Ridge provinces of southern New York and Pennsylvania. This similarity suggests that the joint system identified in the report area may extend throughout much of both provinces in these States.—GHW

Woodward, Thomas C. *See* Wold, John S. 05901

Woolheater, Charles. *See* Taft, William H. 06319

06124 **Wright, H. E., Jr.** The roles of pine and spruce in the forest history of Minnesota and adjacent areas: Ecology, v. 49, no. 5, p. 937–955, illus., tables, 1968.

Forest history is traced through late-glacial and postglacial pollen records. Pine was absent from the Great Lakes spruce forest in late-glacial time, although it was part of the boreal forest in New England. With the warming trend, beginning about 12,000 yr ago, spruce deteriorated and was replaced in south-central Minnestta by birch and alder, and these by elm and oak about 9,500 yr ago. In east-central Minnesota, spruce remained until about 10,500 yr ago and was replaced rapidly by jack and red pine from the east. White pine arrived in eastern Minnesota about 7,000 yr ago, just after the prairie and bordering oak savanna expanded from western to eastern Minnesota. At the end of prairie expansion, 4,000 yr ago, white pine expanded slowly, reaching northwest Minnesota about 2,700 yr ago, followed by jack and red pine about 1,000 yr ago.—VMJ

00184 **Wright, William H., 3d.** Phases of folding in the slate belt of west-central Vermont [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 64, 1969.

05883 **Wulf, George R.** Catalog of formation names, Black Hills region, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 231–240, 1968.

One hundred and fifty units, including groups, formations, members, and other categories are listed alphabetically; they range from Cambrian to Oligocene, and Pleistocene in age. Included also is a brief description of distribution of each unit, bibliographic reference and type section, gross lithology, and general remarks.—HRC

Wulf, George R. *See* Wyoming Geological Association. 05903

05905 **Wulf, George R.** Lower Cretaceous Muddy Sandstone in the northern Rockies, *in* Black Hills area, South Dakota, Montana, Wyoming—Wyoming Geol. Assoc., 20th Field Conf., 1968, Guidebook: Casper, Wyo., Petroleum Inf., p. 29–34, illus., 1968.

The so-called Muddy Sandstone of Cretaceous age in the northern Rockies is the objective of the hottest oil play in North America at the present time. The Muddy is divisible into two lithologically, genetically, and stratigraphically different units. The lower Muddy, of Skull Creek age, consists of channel sand, channel-mouth bars, and shallow-water shelf sands all deposited in relation to a regressive Gulf-connected sea. The upper Muddy is a sand of Mowry age deposited in the shallow shelf areas of a transgressive Arctic sea. The upper Muddy is called Dynneson, and the lower Muddy, Newcastle or Birdhead. The giant Bell Creek field in southeastern Montana produces from the upper Muddy, and the Recluse area in northeastern Wyoming from the lower Muddy.—*from* Author's summary

00185 **Wynne-Edwards, H. R.; Hasan, Zia-ul.** Intersecting orogenic belts across the North Atlantic [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 64–65, 1969.

05903 **Wyoming Geological Association; Wulf, George R.** (editor). Black Hills area, South Dakota, Montana, Wyoming—20th field conference, 1968, guidebook: Casper, Wyo., Petroleum Inf., 244 p., illus., tables, 1968.

This guidebook contains 32 articles (cited separately) dealing with various aspects of the geology of the Black Hills area of South Dakota and neighboring states. There are fourteen papers dealing with oil and gas, five with uranium, three with coal, and ten with ground water and other minerals. A road log for a two-day field trip is included.—HRC

05929 **Yedlin, Neal.** Memorial of Peter Zodac (Sept. 14, 1894–Jan. 27, 1967): Am. Mineralogist, v. 53, nos. 3–4, p. 619–622, portrait, 1968.

00186 **Yochelson, Ellis L.** Charles Doolittle Walcott's early life and budding career, 1850–1879 [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 65–66, 1969.

05863 **Yochelson, Ellis L.; Jones, Clive R.** *Teiichispira*, a new Early Ordovician gastropod genus: U.S. Geol. Survey Prof. Paper 613-B, p. B1–B15, illus., 1968.

The new macluritacean genus *Teiichispira* has an elongate horn-shaped operculum, having a fibrous texture when weathered. The type species *Teiichispira kobayashi* is widespread in the Setul Formation of Malaysia. A congeneric operculum has been described from the Odenville Limestone of Alabama as *Maclurea? odenvillensis*. Another new species, *T. rossi*, known only from its operculum occurs in Utah. *Maclurea sylpha* Billings, from Newfoundland, is tentatively placed in this genus. Several groups of fossils suggest a very late Early Ordovician age for the type species, as well as for the species from other localities. Opercula of *Teiichispira* may be potentially useful for dating rocks of latest Early Ordovician age because of their widespread, though scattered distribution and because they are readily identified from even fragmentary specimens.—ELY

00101 **Youash, Younathan.** Tension tests on layered rocks: Geol. Soc. America Bull., v. 80, no. 2, p. 303–306, illus., table, 1969.

Four cores, a shale, a gneiss, and two sandstones, were prepared, with the layers dipping at 0°, 15°, 30°, 45°, 60°, 75°, and 90° to the short cylinder axis. Tests were carried to failure, and strain was measured by gauges mounted on the cores. For 0° to 60° cores, failure was along layering; for 75° and 90° cores, failure was across layering. Rupture strength in tension is lower if failure occurs along layering than if it occurs across it. It is postulated that during rock deformation, involving tension, rocks are more likely to fail along pre-existing weakness planes, such as joints, faults, bedding, lamination, and foliation, than across weakness planes. Theories of failure that assume material is homogeneous and isotropic, whether in tension or in compression, do not apply to rocks that have definite planes of weakness.—RAL

05992 **Young, Bob; Young, Jan.** Frontier scientist—Clarence King [1842–1901]: New York, Julian Messner, 190 p., 1968.

Young, Jan. *See* Young, Bob. 05992

Zarrella, W. M. *See* Schrayer, G. J. 05906

00187 **Zartman, Robert E.** Early Paleozoic plutonism near Boston, Massachusetts [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 66, table, 1969.

Zeiss, Harvey S. *See* Newman, Walter S. 00236

00188 **Zeizel, Arthur J.** Geology and metropolitan resources planning [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 66–67, 1969.

00158 **Zeller, H. D.; Stephens, E. V.** Geology of the Oregon Buttes area, Sweetwater, Sublette and Fremont Counties, southwestern Wyoming: U.S. Geol. Survey Bull. 1256, 60 p., illus., tables, geol. map, 1969.

Except for scattered outcrops of crystalline Precambrian rocks along the north margin of the area, exposed rocks are Tertiary sediments. Eocene rocks in ascending order are: Wasatch Formation, Tipton Shale Member of Green River Formation, Cathedral Bluffs Tongue of Wasatch, Wilkins Peak and Laney Shale Members of Green River, and Bridger Formation. Miocene Arikaree Formation unconformably overlies the Bridger, and is overlain by Miocene–Pliocene South Pass Formation. Surficial deposits include widely spaced remnants of high-level terrace gravel. Two large-scale NW-trending faults occur; folds are scarce. The southern half is

underlain by coal beds in the Fort Union Formation, structures indicate a good potential for oil and gas production, and placer gold occurs in alluvial deposits north of the Continental fault.—*from* Authors' abstract

00189 **Zenger, Donald H.** Stratigraphy of the Little Falls Formation (Upper Cambrian) in the type area, east-central New York [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 67–68, 1969.

Zimmermann, R. C. *See* Comer, G. H. 00069

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